

MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 38

NOVEMBER, 1931

Number 3

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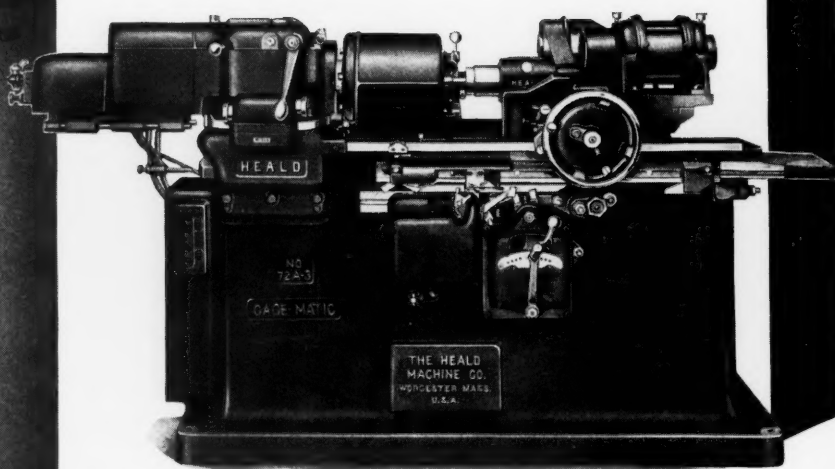
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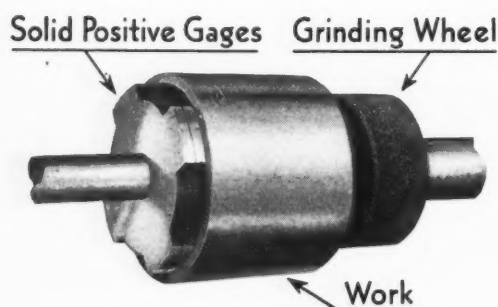
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HEALD

MACHINERY

Volume 38

NEW YORK, NOVEMBER, 1931

Number 3

Promoting Permanent Prosperity

By JAMES W. HOOK, President
The Geometric Tool Co.

When Mr. Hook first conceived the idea that some of the most serious effects of business depressions might be overcome if each industrial concern would provide a reserve for the purpose of helping to maintain the income of its stable workers, where these incomes lie within a certain range, he thought of the plan mainly as a means of preparing for the next depression. But as his idea developed, it became clear that it has much greater possibilities. It is a means for establishing a more evenly distributed volume of business. It will tend to prevent depressions of such serious aspects as those with which we have become familiar and will aid in promoting permanent prosperity.

Here we have a plan, which, if adopted generally, would place industry in a position to do voluntarily and efficiently what



Outline of a Practical and Business-like Method by which Permanency of Income may be Assured the Stable Workers in Industry, and the Extreme Peaks and Valleys of the Business Curve Ironed Out

otherwise, according to all indications, our National Government will undertake to do in a manner that experience abroad has proved to be unsatisfactory and inefficient. Other plans have been and will be proposed. Perhaps the final solution will be a combination of the best features of them all. The important thing is that industrial leaders are thinking constructively along these lines.

During our present business depression, temporary relief work is necessary, but the plan here proposed is of far greater importance than any temporary unemployment relief. It presents a working basis for the future, a method that will prevent extreme unemployment distress in years to come. It is a plan to which every executive in the industries throughout the United States should give most earnest consideration.

I CANNOT but believe that unless industry as a whole devises some plan for assuring permanency of employment for its stable workers, we are headed for some kind of state unemployment insurance in this country. If it comes, it will take the form of a tax on industry, and those employed in industry, to pay benefits to all unemployed whether they are deserving or not. Advocates of state insurance will say that the law will amply guard against paying benefits to the undeserving, the shiftless, and the loafers. Maybe it will at first, but if experience repeats itself and politics play true to form, before long everyone will be included and benefits will be increased and prolonged.

The potentialities of a state unemployment insurance plan embrace virtually all factors neces-

sary for the destruction of all that has proved best in the capitalistic form of society. Not only does it contain the possibility of overtaxing the provident to furnish a livelihood for the improvident, but it would also serve, to a certain degree, as an incentive for the improvident to become more improvident.

But has industry offered an alternative plan? To date it has not; as ever, it remains inarticulate while the fires are being struck on every side. To my mind, it ought to solve the problem itself.

Will any forward-looking executive deny that he owes a responsibility to the stable force of workers in his employ? They are, by all odds, the most important single factor contributing to the success of any industry. They represent a substantial

portion of our citizenship—men and women who want to work, who have families to support and homes to maintain. They are distinguished from the casual or nomadic type of worker that does not work or desire steady work, that likes one kind of job in winter and another kind in summer, and that likes to be moving about from town to town and job to job.

Admitting its responsibility to its stable group of employees, the company whose management the writer is privileged to direct has carried through what might be termed an experiment which proves that if we recognize our responsibility there are no unsurmountable obstacles in the way of meeting it. We have proved that it is possible to set aside, during prosperous times, a reserve sufficient to tide our stable employees over extended periods of depressed business. Having proved this to our own satisfaction, we would like to see a substantial group of important employers throughout the country accept this principle, and develop a similar plan in their own plants. With this nucleus backed by trade organizations urging others to follow, it would not be long before reserves for this purpose would be thoroughly accepted as a sound business principle, just as reserves for depreciation, for retirement of debt, and for payment of dividends now are.

Once the principle of an obligation to stable workers is accepted, specific plans to discharge the obligation would be only a matter of conference in the different industries. Government should permit such conferences and aid in them. Trade associations should bring groups together and disseminate information and experience that would help their members to develop workable plans.

In my judgment, it is only some such voluntary plan, evolved and accepted by industry itself, that will check the oncoming march of universal state unemployment insurance.

The Experiment and the Practical Solution Evolved from It

The best way in which to present the subject is, without doubt, to record our own experience during the last two years, giving largely the same information as was presented in a recent service letter on industrial relations, published by the National

Industrial Conference Board. We began by casting about for means to meet the present business depression. What we have done has convinced us that if industry in general will adhere to a few simple, practical, and business-like principles, the effect of future depressions can be greatly minimized, and all businesses placed on a much firmer foundation than that on which they rest today.

Late in 1929 when it seemed apparent that a depression of some proportions was in prospect, we began to anticipate its effects upon our working forces. Our first move was to cease replacing em-

ployees who voluntarily quit their jobs. By February, 1930, our working force was practically stabilized. Normal working time was afforded the entire force until late in June, when the full effects of the depression hit us. We had planned ahead for this eventuality and at once put the plan into effect. There was so much work to do. There was a certain stable force of workmen to do it. We began at once to divide the work, giving each employee his share. Those with dependents were given a larger share than those without.

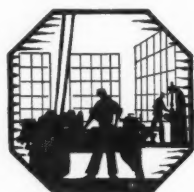
The management, including all the department heads and foremen, put forth every effort to keep the men on the payroll and working. Odd jobs were listed and disposed of during unusually bad weeks. Every machine in the factory was cleaned and painted, the factory interior was painted, and all windows washed; machinery was relocated; worn jigs and fixtures were repaired or entirely reconstructed; floors were cleaned; and all pipes in the entire

factory were painted distinctive colors so that they could be identified at any point by reference to a color key.

Some of our finest and most highly skilled workmen did these odd jobs. Rarely did anyone turn up his nose at being asked to paint, clean windows, or do other messy work. In fact, in most cases, the workmen considered it a privilege to get the extra work, even though, in some instances, it paid less than half of what they had been accustomed to receiving.

The fine spirit exhibited was due largely to the fact that the superintendent and foremen not only directed the work personally, but also took an active hand in it. Working men can always be depended upon to respond to sincere leadership that

The records kept in the plant managed by the author of this article have proved conclusively that it is practicable to set up reserves during six or seven good years to maintain the wages and salaries of the stable group of employees at 80 per cent of normal for those with dependents, and at 60 per cent for those without, even though the period of depression be considerably prolonged, as it has been during the last year and a half. In fact, a reserve of 3/4 of 1 per cent of the payroll set aside during the years 1923 to 1929, inclusive, would have been sufficient to maintain the pay of the stable group of employees for one year.



recognizes no social strata and that considers all work as dignified and worth while. In distributing the extra work, the foremen avoided the appearance of urging men to accept it. Instead, they merely offered it to those who were most likely to accept it by reason of their home obligations and need for extra income. The system we used to determine who were the most needy, described farther on in this article, was so conclusive that our fairness has not once been questioned.

Up to the present, sixty-eight weeks of short-time work in our factory have gone by. This, for our purpose, is considered the depression period to date. During that time our business has shown a recession of 52 per cent from 1929 and of 43 per cent from 1928. Yet, withal, our force since January, 1930, has been depleted only by voluntary quits and dismissals for incompetence and for gross infractions of rules that could not be overlooked.

During this whole period a continuous weekly record has been kept which shows the precise effect the depression has had and is having on the time worked and wages received by every employe in the business who has been on short time. A facsimile of one page of this record, with employes' names changed, is shown. As will be noted, the record takes into account the age and number of dependents of each employe, the date of his employment by the company, the hours he worked, and the wages he received each week.

After each nine-week period, composite figures are compiled to show the average time he has worked and the average wages he has received per week over the entire period since his hours were shortened. After this is shown what his normal working hours and earnings would have been had he worked full time, and in another column the percentage of hours worked and wages received for the entire depression period.

This record, when once started, was not only very easy to maintain, but was also of great value to the management and executives in charge who were trying to spread the work that had to be done in the most effective manner. Employes with dependents to support were favored whenever and wherever their abilities permitted. Men limited to one specific activity were put on a work stagger, one man or one group of men working one day or

week, and the other the following day or week. A case in point in the table accompanying this article is shown by the alternate weeks of work given to Louis Katen and John Grillo.

But the tables have another and a deeper significance to us than that of enabling us to distribute available work intelligently. The percentage columns at the right, based as they are upon the most acute business situation that is likely to descend upon us, become, as the depression advances, the very best of actuarial data. Not only do these percentages show the precise effect of the depression upon individual employes, but in combination, they show also the effects upon departments and the business as a whole.

In our business, these percentages have been most revealing. They have proved to us some important facts relating to unemployment benefits. They have shown us that it would not be such an expensive thing to set up reserves during six or seven good years to maintain wages and salaries of the *stable* group of employes in our company (employes who have been in our employ one year or more) at 80 per cent of normal for those with dependents, and 60 per cent for those without, during very long periods of short-time work in our factory. In fact, to be precise, a reserve of three-quarters of one per cent of our payroll set aside during the years 1923-1929 would have been sufficient to have maintained the pay of our *stable* group of employes at the percentages mentioned for a period of fifty-two weeks beginning June 27, 1930. During the

same period the company provided in other reserves an equivalent of 13 1/2 per cent of the same group of payrolls.

Of course, in view of seasonal variations in business and of lesser depressions that come along every two or three years, the reserves would be somewhat depleted during the period of their accumulation, so that one could hardly expect the entire amount set aside to be on hand at the beginning of a major depression.

Businesses in some cases are beset with such unbridled competition that even a reserve as small as three-quarters of one per cent of the payroll might be a burdensome load to carry. Until an enlightened public mind seriously attacks the problem of controlling our production and definitely tries to

The problem of setting aside reserves to take care of stable workers in industry during periods of business depressions is closely tied up with the broader problem of maintaining industry on a sufficiently profitable basis during good years to enable it to meet periods of depression with ample reserves. Unbridled competition in some branches of the industry may make it difficult to set aside even a small reserve. Until an enlightened public opinion seriously tries to understand the part that uncontrolled competition plays in creating booms and depressions, the conditions that cause unemployment are likely to continue.



understand the part that unbridled competition plays in it, business fears that force people out of employment and keep wages at bare existence levels will continue.

What We Mean by "Stable" Workers

As will be noted, reference is being made constantly to our stable workers. Who are the stable workers in industry? In the plan just described, the stable workers were those who were on the payroll of the company when weekly hours in the plant were shortened. Employees on any payroll at that time are pretty sure to be the ones whom the management wishes to keep. In our own case, every one of the employees who were retained and put on short time had been in the employ of the company a year or more. We found, too, that of the 26 per cent who left the company between June, 1929, and March, 1931, practically all had been on the payroll less than a year.

This has led us to the conclusion that in our particular business, stable workers should be defined as those who have been continuously on our payroll a year or longer immediately preceding the commencement of a decline in business of proportions severe enough to require a contraction of forces or a shortening of hours.

The plan outlined takes care of the stable workers that form the real backbone of our industrial community. Of course, society cannot abandon the casual or nomadic worker. Work of some kind must be provided for him. This may be done by public work planned in advance; and for those afflicted by physical or mental disability or illness,

help must be given by charity or by institutions maintained for the purpose.

Even Depressions Have a Purpose if We Learn from Them

Our experience has convinced us of one very pertinent fact; namely, that careful management and intelligent spreading of work will go a long way toward tiding wage earners over depression periods. It has convinced us also of the very great importance of individual units of industry taking advantage of a great depression period, such as we are now passing through, to record its precise effects upon wages and hours in a manner similar to that followed in our plant.

Information of this kind, aside from the assistance it gives to management in distributing work intelligently, cannot fail to be of great value to any company when the depression is over and every employe is back on full time. Its data can be used effectively in showing the fallacies of dangerous proposals and wild, immature schemes. In addition, it is the sort of information that will be needed in the preparation of plans to meet the next depression, if and when it comes.

In comparing the plan proposed with any scheme of national unemployment insurance, one important difference should be noted. It is evident that there would be a maximum amount required in the reserve fund built up by each concern. This maximum would depend upon the number of employes and the general character of its business. When this maximum was reached, no further reserves would need be set aside for this purpose.

Record of Work and Earnings of Employees During a Period of Reduced Business Activity

Employee's Name	Age	Dependents	Man's No.	Week Ending										Totals 52 Weeks	Average Hours Worked and Wages Received per Week During Depression*	Normal Full Time Hours and Earnings per Week	Per Cent to Normal of Hours Worked and Wages Rec'd During Depression*	Remarks	Date Employed
				May 2	May 9	May 16	May 23	May 30	June 6	June 13	June 20	June 27							
Chas. Jones	29	0	1	Hrs.	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	1452.6	27.4	50.0	55	Versatile	6-30-20	
				Amt.	16.20	16.20	16.20	16.20	16.20	16.20	16.20	16.20	855.36	16.40	30.00	55			
Wm. Smith	49	2	3	Hrs.	45.0	41.0	45.0	45.0	45.0	45.0	45.0	45.0	2305.2	44.5	50.0	89		7-12-12	
				Amt.	36.00	32.80	36.00	36.00	36.00	36.00	36.00	36.00	1847.12	35.50	40.00	89			
Louis Katen	71	0	4	Hrs.	.....	27.0	27.0	.....	27.0	.....	27.0	.....	900.0	17.3	50.0	35	8-16-09	
				Amt.	.....	12.69	12.69	.....	12.69	.....	12.69	.....	423.00	8.15	23.50	35		
Jas. Kelley	32	3	5	Hrs.	27.0	27.0	36.0	54.0	45.0	54.0	54.0	27.0	1750.5	33.6	50.0	67+		5-20-23	
				Amt.	20.25	20.25	24.75	33.75	29.25	33.75	33.75	20.25	1272.37	24.50	37.50	65			
Fred Coe	35	2	6	Hrs.	39.0	45.0	66.0	50.0	57.0	45.0	52.2	27.0	2159.3	41.3	50.0	83+	Very Needy		3-15-20
				Amt.	23.28	26.28	36.78	28.78	32.28	23.34	29.32	17.28	1280.73	24.60	32.00	77			
John Grillo	59	2	7	Hrs.	27.0	27.0	.....	27.0	.....	27.0	.....	27.0	1037.4	19.9	50.0	40		4-6-01
				Amt.	14.85	14.85	.....	14.85	.....	14.85	.....	14.85	570.55	10.95	27.50	40		
Tony Marso	48	4	8	Hrs.	41.0	45.0	54.0	54.0	46.0	54.0	54.0	45.0	2196.4	42.0	50.0	84+	Very Needy		6-3-15
				Amt.	25.36	27.36	31.86	31.86	28.11	31.86	31.86	27.36	1431.78	27.60	34.00	81			
Peter Audi	52	2	9	Hrs.	27.0	27.0	27.0	27.0	45.0	36.0	27.0	27.0	1587.7	30.3	50.0	61		2-4-14	
				Amt.	20.25	20.25	20.25	20.25	29.25	24.75	20.25	20.25	1184.02	22.80	32.50	61			
Thos. Casey	26	0	10	Hrs.	9.5	.....	.....	.....	.....	.....	.....	.....	1243.0	24.0	50.0	48	1-8-27	
				Amt.	5.85	.....	.....	.....	.....	.....	.....	.....	811.80	15.60	28.50	48		
Walter Hess	50	4	12	Hrs.	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	1529.3	29.3	50.0	59		Thrifty	7-6-15
				Amt.	15.39	15.39	15.39	15.39	15.39	15.39	15.39	15.39	871.70	16.70	31.00	59			

*The depression is taken to have begun when hours in the plant were shortened, that is, June 27, 1930.

†These percentages differ because this man was given extra work at an hourly rate that was less than his regular rate.

Hence, a premium would be placed on good management, because the concern that could keep its level of production reasonably even over the years would obviously draw less upon the reserve set aside, and hence reach its maximum sooner. The well managed concern or industry would not be penalized by being asked to pay taxes to maintain a general national unemployment insurance, the need for which would largely be caused by the methods of management of industries or concerns that frequently lay off large numbers of their help.

The removal of fear of unemployment from the minds of stable workers would increase efficiency and maintain a steadier purchasing power; hence the severity of depressions would be reduced. At the same time, the added financial responsibility on the part of management would tend to curb ill-considered expansion in boom periods, and prevent, to a large extent, the difficulties resulting from over-production.

The details of the plan suggested may, of course, have to be worked out in a different manner to suit different industries, but the general principle of a definite reserve set aside to tide stable workers over periods of reduced industrial activity remains the same.

* * *

A new plastic molding material known as "Plaskon" has been developed at the Mellon Institute of Industrial Research, University of Pittsburgh. The new molding compound will be produced commercially by the Toledo Synthetic Products, Inc., Toledo, Ohio. It is said that the methods of molding this compound are very simple, the color possibilities are satisfactory, and objects made from Plaskon will combine a bright color with a hard, lustrous surface. The specific gravity of the new material is 1.43, the tensile strength from 4000 to 6000 pounds per square inch, and the compressive strength from 25,000 to 30,000 pounds per square inch. It is unaffected by alcohol, acetone, oil, and other common solvents. It is also moderately resistant to cold dilute acids, although it will not resist hot or concentrated acids. On the other hand, it is quite resistant to cold dilute alkalis, and will also resist hot dilute alkalis. The scleroscope hardness is from 80 to 95. The material can be machined and polished.

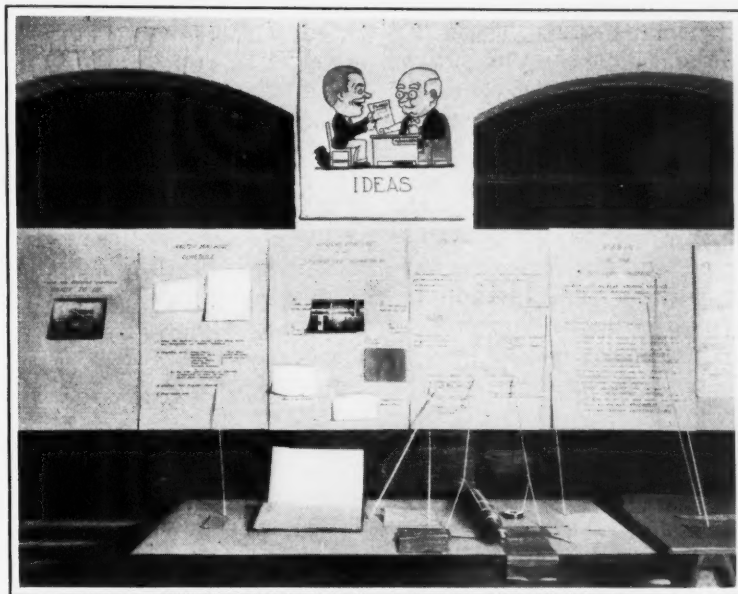
Putting Ideas Across to the Management

Engineers responsible for the operation of industrial plants often find difficulty in making their plans clear to those higher in authority, for the reason that the general manager, president, and members of the board of directors may be principally business men, having only a slight knowledge concerning the details of engineering practices. If the works manager or the shop superintendent can show in dollars and cents what has been accomplished with past appropriations, he will more than likely meet with success in applying for funds to replace obsolete equipment or to institute new methods. The question is, how to do this.

After the Norton Co., Worcester, Mass., had partially completed the rearrangement of plant facilities and practices outlined in a previous article (see September MACHINERY), it was decided that some means should be devised for showing the board of directors, in a tangible manner, just what had been accomplished. If the results could be impressed upon the board members, it was felt that enthusiastic cooperation in carrying out the program would be insured.

The upshot was an exhibit consisting of charts, diagrams, photographs, blueprints, and samples of work, which showed improvements that had been made. This exhibit was arranged around the four walls of a room in the manner illustrated. On a given date, the directors met in this room, together with other officials of the company. The various exhibits were explained by the works manager and his assistants. For instance, one man described the revised lay-out of the plant; another, the proposed incentive system; a third, the new routing and rate-setting methods; a fourth, the new planning system; a fifth, the new toolmaking practices, and so on. The talks required about two hours.

This method of "selling" ideas to the management was received so enthusiastically that the Norton Co. had to repeat the performance several times before groups of executives from other plants, as well as students from the Worcester Polytechnic Institute.



Part of the Exhibit Used to Explain to the Board of Directors the Improvements Made in Shop Methods

Special Tools and Devices for Railway Shops

Recommended by Railway Shop Superintendents and Foremen



Making Locomotive Sectional Piston-Rings

The steam locomotives used on the Canadian National Railways are equipped with piston-rings of the sectional type shown in Fig. 2. These sections are flat on one side and have a groove in the other. The radii of the inner and outer edges are made to suit the piston to which the ring sections are to be fitted.

Six of these piston-ring sections, laid end to end, form a circle. Two such sets are assembled in the groove of a locomotive piston with the grooved sides of the sections face to face, and with a long small-diameter coil spring extending around the annular hole formed by the groove in the sections. This spring holds the sections in place radially, and at the same time, exerts the required pressure to make the assembled piston-ring fit the cylinder bore snugly. Endwise location of the ring sections is governed by the groove in the piston.

The operations performed in making these sectional piston-rings at the Montreal Shops of the Canadian National Railways are shown in Figs. 1, 3, and 4. First, solid rings are cut from nickel-iron castings of cylindrical shape. These castings are about 18 inches long and vary from 20 to 27 inches in outside diameter, depending upon the required dimensions of the piston-ring.

The first operation is performed on the vertical turret lathe illustrated in Fig. 1. It consists of turning the outside for practically the entire length with a cutter mounted on the side-head and of boring the inside with a tool held on the turret. After the outside and inside

have been machined to the radii desired on the piston-ring sections, a second tool on the turret is used to cut a groove around the top edge of the cylindrical casting. Then a narrow-edged tool is used on the side-head to cut a ring of the specified thickness from the top of the casting.

This process of using a vertical grooving tool and a side cutting-off tool in sequence is followed until the casting has been cut down to the jaws that hold it on the table of the machine.

The solid rings produced in the vertical turret lathe are split into sections by means of the equipment shown in Fig. 3. This equipment consists of a fixture *A* in which the ring is located centrally as shown at *B*, resting on six knife-edges. The hinged cover *C* contains six knives or chisels *D*, shaped to conform with the contour of the piston-ring on the grooved side. The chisels are located directly above the knife-edges of the fixture *A* when the cover is fastened down for the operation. The shanks of the chisels *D* are guided in bushings that project slightly above the top of cover *C*.

After the cover has been lowered on the fixture and clamped by operating the air valve *E*, the operator strikes the projecting shank of each chisel *D* sharply with a copper hammer. Each blow produces a clean break in the piston-ring directly beneath the chisel without the loss of any material.

As soon as the sections have been produced as explained, they are marked for identification purposes and numbered from 1 to 6.

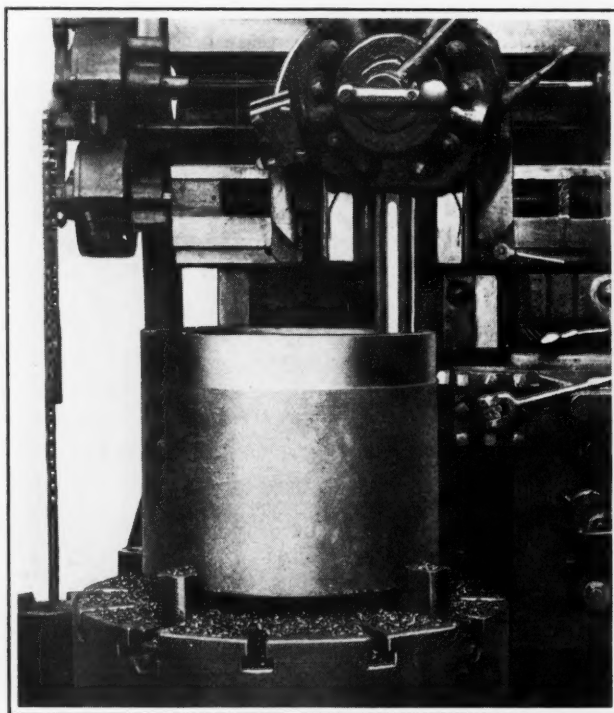


Fig. 1. Solid Rings with a Groove on One Side are Cut from Large Cylindrical Castings

This is to insure the assembly of the sections around a locomotive piston in the same order that they are in at the end of the breaking-up operation. As the sections are taken from the fixture, their ends are smoothed with the wheel of an adjacent floor-stand grinder.

The last operation on the piston-ring sections is to grind both sides on the surface grinder illustrated in Fig. 4, which is equipped with a magnetic chuck. Twelve pieces, or one complete set, are ground at a time.

Upon being taken from this machine, the twelve sections are dipped in oil to guard against rusting, wrapped in burlap, wired for compactness, and tagged to show the ring size. They are then placed in storage until requisitioned for use. O. H.

* * *

"Blown-up" Radiators

An ingenious method of making transformer radiators is used in the plant of the Westinghouse Electric & Mfg. Co. at East Pittsburgh. Briefly, two long strips of steel, 0.050 inch thick, are welded together around the edges, and are then blown up by air pressure to form a radiator section.

The flat steel sheets are first cut out to the right shape and are then placed back to back, being welded air-tight along the rim. This work is done

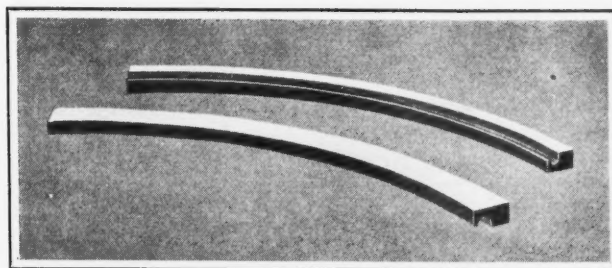


Fig. 2. Sectional Nickel-iron Piston-rings Used in the Locomotives of the Canadian National Railways

by automatic resistance seam-welding machines. This flat, air-tight, metal bag is then placed between the retaining walls of a jig, and air pressure at 90 pounds per square inch is applied between the sheets, thereby inflating the steel shell, bulging the sides, and producing a light, rugged, cooling section. After welding, inflating, and forming,

several cooling sections are grouped together with a common header to form a radiator. As all the welded surfaces are on the outside, they can easily be inspected. The parts are readily cleaned and painted, and there are no pockets to collect water.

* * *

An entirely new type of railway car will shortly be placed in service by the Philadelphia & Western Railway Co. for the use of suburban commuters. The running time of these cars from Norristown to the 69th St. station in Philadelphia, a distance of 13 1/2 miles, will be cut from the present 24 minutes to 16 minutes. The cars are of streamline design, built with aluminum bodies, and are capable of a speed of eighty miles an hour. One of the new cars was shown at the convention of the American Electric Railway Association at Atlantic City this fall. Cars weighing 65,000 pounds and having a maximum speed of 45 miles an hour are being retired in favor of these 50,000-pound cars.

Fig. 3. The Solid Rings are Split into Six Sections through the Use of the Equipment Illustrated

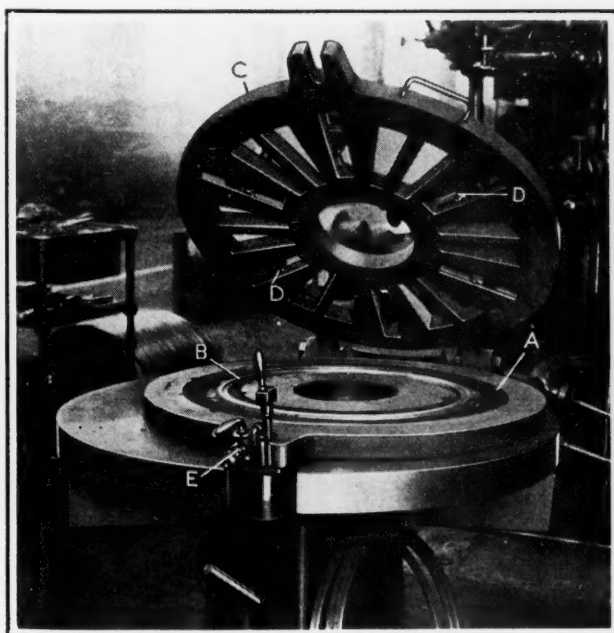
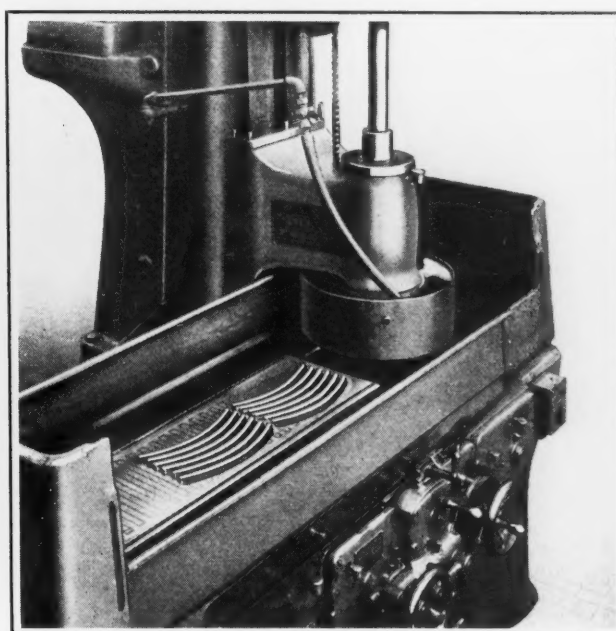
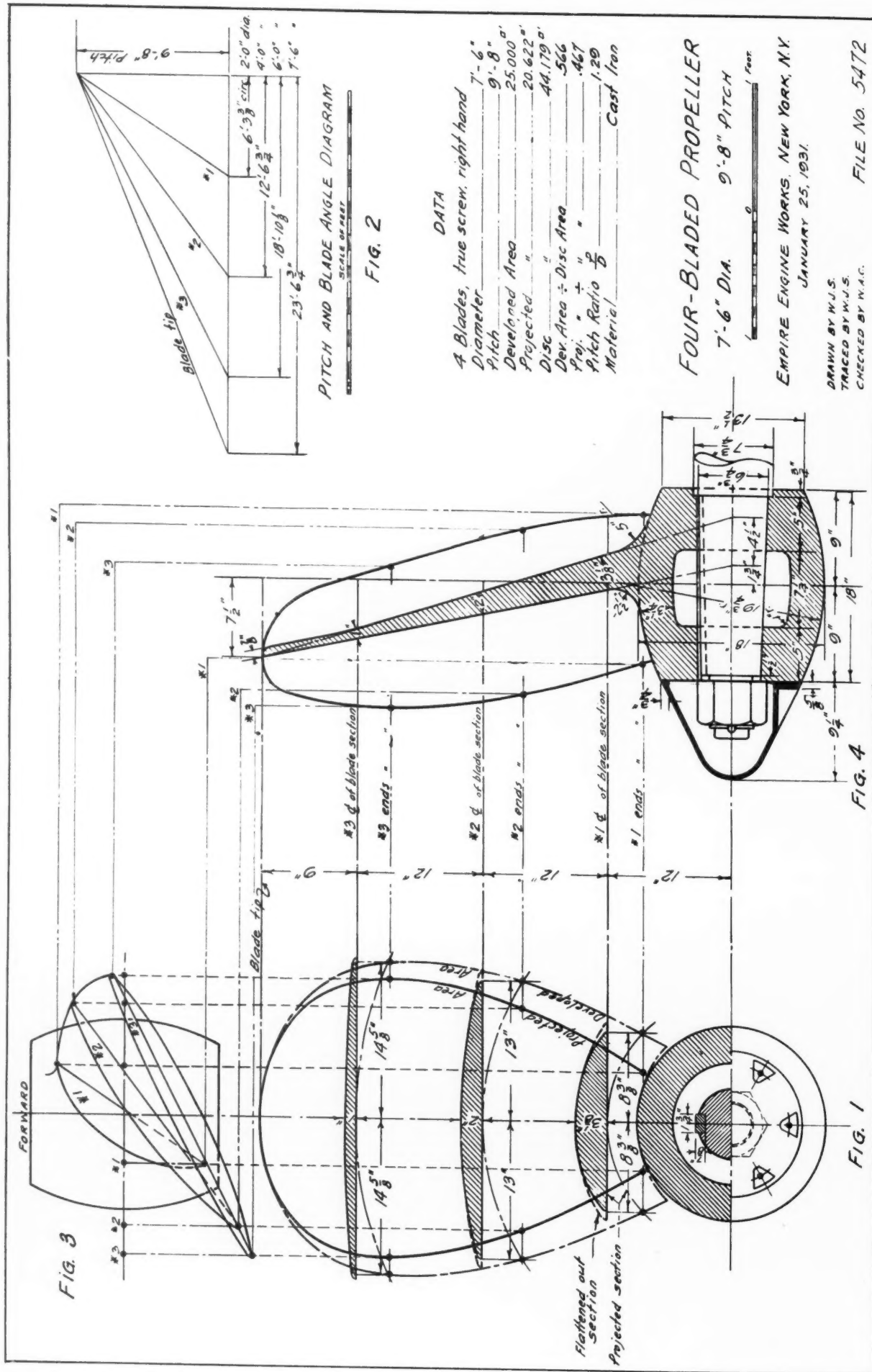


Fig. 4. The Piston-ring Sections are Surface-ground on Both Sides in Sets of Twelve as Shown





Working Drawing of a Screw Propeller Blade, Showing Projected and Flattened Out Sections

How to Draw a Screw Propeller Blade

By WILLIAM J. STANTON, Senior Draftsman, War Department, U. S. Engineer Office, Philadelphia, Pa.

THE method of drawing a propeller blade here illustrated is, the writer believes, the simplest and most practical of any method yet devised. It is especially recommended to all draftsmen and engineers who desire to employ a simple and direct method that will give all the information and guidance required by the patternmaker and the machinist in carrying out their work.

It is understood that all matters of sizes and design will be predetermined by reference to engineering handbooks or from previous examples of propellers that are to be redesigned. Our sole object here will be to discuss a practical method of laying down the wheel in the simplest, quickest, and most understandable way, with regard to the requirements of the draftsman entrusted with the drawing work and the patternmaker who is to be the actual builder of the propeller.

The method described is really a modification of that used by the British Admiralty, combined with the best features of other methods used by several of the leading shipyards in this country. It conveys nothing but the essentials necessary for the proper construction of the propeller pattern, the casting of the propeller at the foundry, and the final machining operations in the shop.

First, draw the developed area of the blade, as shown in Fig. 1. As stated, this will be predetermined to suit the particular conditions of propulsion. This area will be shown on the blade elevation, Fig. 1, with one half of the propeller hub shown in full and the other half in section. Next, draw arcs on the developed area from a common center at the hub, and with radii of lengths equal to the distance from the hub center to the points where the sections are to be taken on the blade. These sections will show the thickness of the blades at these points; this thickness is derived from the vertical section shown in Fig. 4.

The curved side of these sections should properly be a true arc, terminated at the blade edges. These edges should have about a 1/4- to a 3/8-inch radius. The straight or flat side of the blade is the contact surface of the propeller. This is, correctly speaking, the front of the blade, while the curved side, with its strong-back effect, is the rear side of the blade. The lengths of these sections are determined by the vertical projection of the intersections of the arcs with the periphery of the developed area of the blade. It is customary to show the sections flattened out, and this may be done with sufficient accuracy by stepping off the lengths of the respective arcs and superimposing these lengths on the same lines of the projected circumferential sections by means of a compass set for short steps or intervals. This flattened lay-out is also referred to as the developed or expanded section of the blade.

Now, draw the pitch and blade angle diagram shown in Fig. 2. This diagram is used to determine the angular positions of the blade sections that are shown in the top view in Fig. 3. It will be noticed that the sections shown in the top view are the short or projected sections that are drawn in the elevation of the developed area, and not the flattened out or expanded sections of the blade.

The next step is to draw short horizontal lines toward the vertical center line in Fig. 1 from the previously mentioned intersecting points on the developed area. Drop vertical lines from the blade tips in Fig. 3 to intersect the short horizontal lines in Fig. 1. A curve drawn through these points will give the projected area of the blade.

Now, draw the wheel in vertical section, as shown in Fig. 4, with a suitable rake or slant to the blade, or no rake at all, as the case may require. This is one of the most important views on a propeller drawing and one that is invariably left unfinished or incorrectly projected by the majority of marine draftsmen. The part of this view in question is the outline of the blade, and to prove that it is most important to show this fully and correctly, it is only necessary to note where the points fall in the projection of the after side of the blade. Where these points approach the hub of the propeller and drop on the outside of the after-hub face, the root of the blade must be advanced far enough ahead of the vertical center line, so that the terminating point of the curve may be brought just within or slightly forward of the after face of the propeller hub or boss.

In plotting the curve of the blade on this sectional view, the top of the plan view, Fig. 3, may be redrawn above Fig. 4 and the points in the curve found by dropping verticals from the blade tips, as was done with the projected area on the elevation in Fig. 1. Then horizontals projected from the intersecting points on Fig. 1 to the verticals in Fig. 4, will give the correct points on the sectional view.

The pitch and blade angle diagram, Fig. 2, may be drawn to any suitable scale, the larger the better, so as to get the greatest accuracy in the angle of each section of the blade in Fig. 3. Obtain the areas of the developed and projected views of the blade by a planimeter or by mathematical calculation. Measure one-half of the blade, if it should prove to be a uniform lay-out on each side of the center line, and multiply this by 8 if the wheel happens to be a four-bladed one; or by 6, if a three-bladed one, and so on. However, if the blade is not of symmetrical shape and of equal size on both sides of the center line, then the entire area of the blade must be found and multiplied by the number of blades in the wheel.

Particular care should be taken to see that all

views are projected correctly. Not one unnecessary line is shown in the accompanying illustrations. The temptation to put down just one more view and a few more lines or notes for good measure simply makes the blueprint more difficult to read. The required data should be filled in as shown. A neat, intelligible title should be placed in the lower right-hand corner of the sheet to make the drawing of the screw propeller complete.

* * *

Hartford Industrialists Honored

In order to honor the pioneer industrialists of Hartford, who have made so large a contribution to industrial progress, not only in the United States, but throughout the world, a group of Hartford manufacturers have formed themselves into a corporation known as Industrial Memorials, Inc. The aim of the organization is to perpetuate, by means of memorials and other feasible ways, the pioneers and founders of industry in Hartford, Conn., to collect and preserve information, and to promote public education in such matters.

On September 16, dedication exercises were held at the State Trade School in Hartford, and memorial tablets were unveiled to eight prominent industrial pioneers. The men thus honored were: Charles E. Billings, pioneer in the drop-forging industry and founder of the Billings & Spencer Co.; George J. Capewell, inventor and founder of the Capewell Horsenail Co.; Samuel Colt, inventor of the Colt revolver and founder of the Colt's Firearms Mfg. Co.; Asa S. Cook, inventor and manufacturer of automatic machines for making wood screws and founder of the Asa S. Cook Co.; Francis A. Pratt, pioneer in making machine tools of high accuracy and founder of the Pratt & Whitney Co.; Elisha K. Root, pioneer of manufacturing interchangeable parts for firearms of the Colt Armory; Christopher F. Spencer, whose inventions have profoundly influenced industry in Hartford; and Amos Whitney, director in making precision tools and co-founder of the Pratt & Whitney Co. Bronze tablets bearing bas relief portraits of these men were placed in the lobby of the building, and a bronze figure was erected in front of the building to symbolize invention, design, and engineering. Members of the families of those represented by the portraits and the manufacturing interests founded by these men provided the means to insure the undertaking.

Grinding Magnesium Alloys

By W. E. WARNER, Herts, England

Magnesium alloys are about two-thirds as heavy as aluminum and are coming into use in cases where lightness is desirable or necessary. Magnesium can be ground with wheels similar to those used for grinding aluminum alloys, using a work speed of 80 feet per minute and a peripheral speed of 1000 feet per minute. A moderate cut and a moderate work speed should be used.

The best wheels for grinding this alloy belong to the silicon carbide group. Carborundum wheels may be used, but the writer has found that Crys-tolon wheels generally give the best results. These wheels should be medium hard and of from 30 to 46 grain. The exact grain can best be determined

by trial, as the magnesium alloys vary somewhat. Clogging of the wheel is likely to occur, the same as with aluminum, but this can be prevented by using a large supply of coolant.

Kerosene can be used as the lubricant or coolant, or if desired, a 4 per cent hydrous sodium fluoride solution may be employed. Emery wheels or emery powder must not be used on magnesium alloys. If the magnesium alloy is to be polished, the same methods as are employed for polishing aluminum may be used.

A disadvantage of magnesium is that it is very inflammable when in a finely divided form. The best fire preventive measures are to remove all magnesium dust

each day and to keep asbestos cloths and a supply of dry sand always available to smother any fire that may occur.

* * *

Preserving MACHINERY'S Data Sheets

By EDWARD HELLER

As the pile of MACHINERY'S Data Sheets increases, the original binders are likely to be outgrown. The writer has found it convenient not to cut the sheets in two, but just to trim them to an 8 1/2- by 11-inch size and bind them in a Shipman's "Common Sense" binder No. 128-C. This binder does not retain the sheets by rings, but holds them tightly as in a book. The size of binder mentioned will hold sheets up to a total thickness of 2 1/4 inches, which means that one binder will be sufficient for MACHINERY'S Data Sheets for many years to come.

Machine Tool Frames Produced by Welding

By J. R. WEAVER, Superintendent, Manufacturing Equipment Department
Westinghouse Electric & Mfg. Co.

THE general principles governing the construction of machine tool frames and bases by arc welding are the same as those that apply to the construction of welded jigs and fixtures, as described in October MACHINERY, page 108. The examples of frames and bases here illustrated indicate the possibilities of this method of construction. In building special machine tools, the expense for patterns is usually high, and it is always difficult to know whether to charge the customer for the patterns or to absorb their cost in the general distribution of expense. With the fabricated construction, no patterns need be considered, and it not only saves this expense but also shortens the time of delivery.

Fig. 1 shows a machine for cutting windows in motor frames by means of an acetylene torch. The torch is guided by a templet, as shown, which is

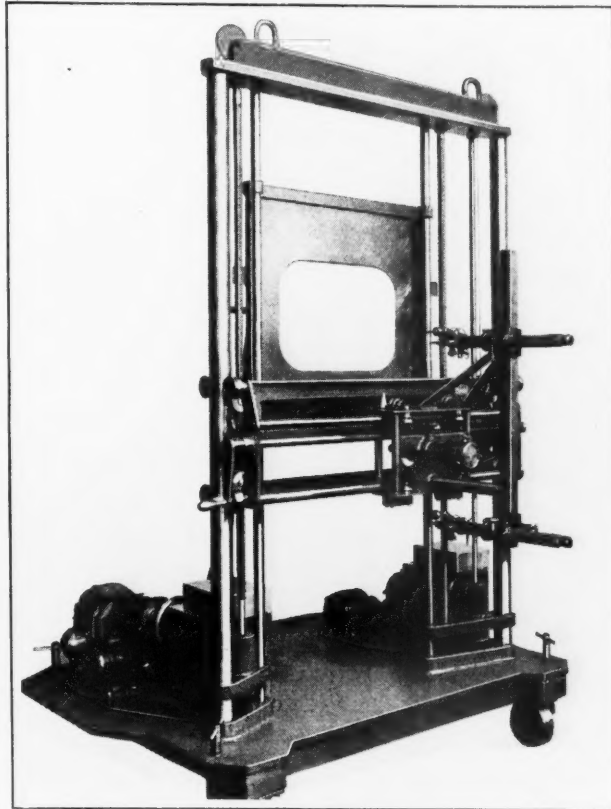


Fig. 1. Acetylene Cutting Machine of Arc-welded Construction

clamped to the machine frame. This machine is constructed entirely by the welding method and is giving entire satisfaction.

In Fig. 2 is illustrated a roller leveler of welded construction, and in Fig. 3 is shown the welded driving head housing of the leveler. Figs. 4 and 5 show a No. 8, 14-foot drilling machine made by the Moline Tool Co., which was constructed by arc welding and delivered within ten days' time. If cast construction had been employed, it would have taken thirty days to build this machine. It is, of course, understood that no patterns were available. The appearance of this machine is obviously as good as though made from castings.

Fig. 6 shows a shear housing of welded construction for the 2 1/2- by 20-inch monitor shear shown in Fig. 7. The assembly of this machine is completely arc-welded with the exception of the

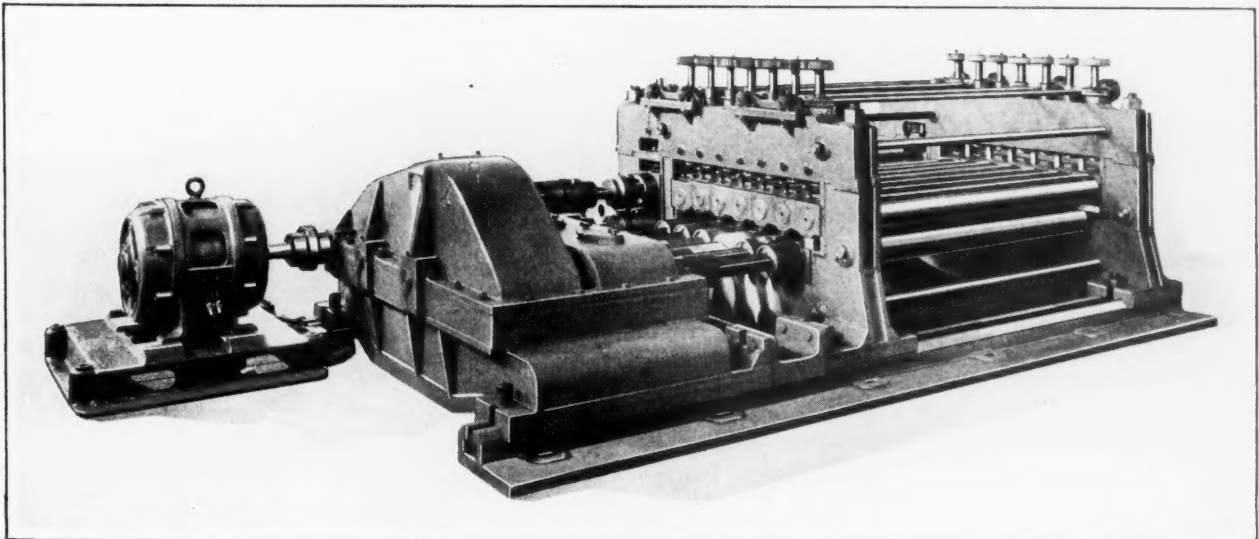


Fig. 2. Roller Leveler with Housings and Gear-case of Steel-plate Arc-welded Construction

gears. The weight of the welded housing is 31,500 pounds. The parts of this machine were developed by Lukenweld, Inc., Coatesville, Pa.

A number of machine tool builders have adopted methods of building special machines similar to the ones here illustrated. Although welded construction is

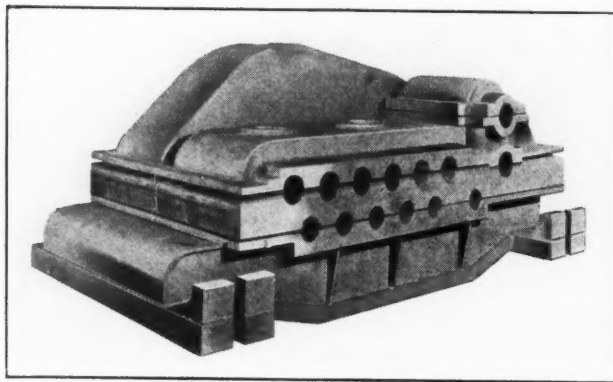


Fig. 3. Gear-case of Roller Leveler Shown in Fig. 2

far as the writer has been able to learn, there are no disadvantages in welded construction that would affect the accuracy, appearance, or operation, while there are definite advantages from the standpoint of cost and time. It is to be expected that more machine tool builders and users of machine tools

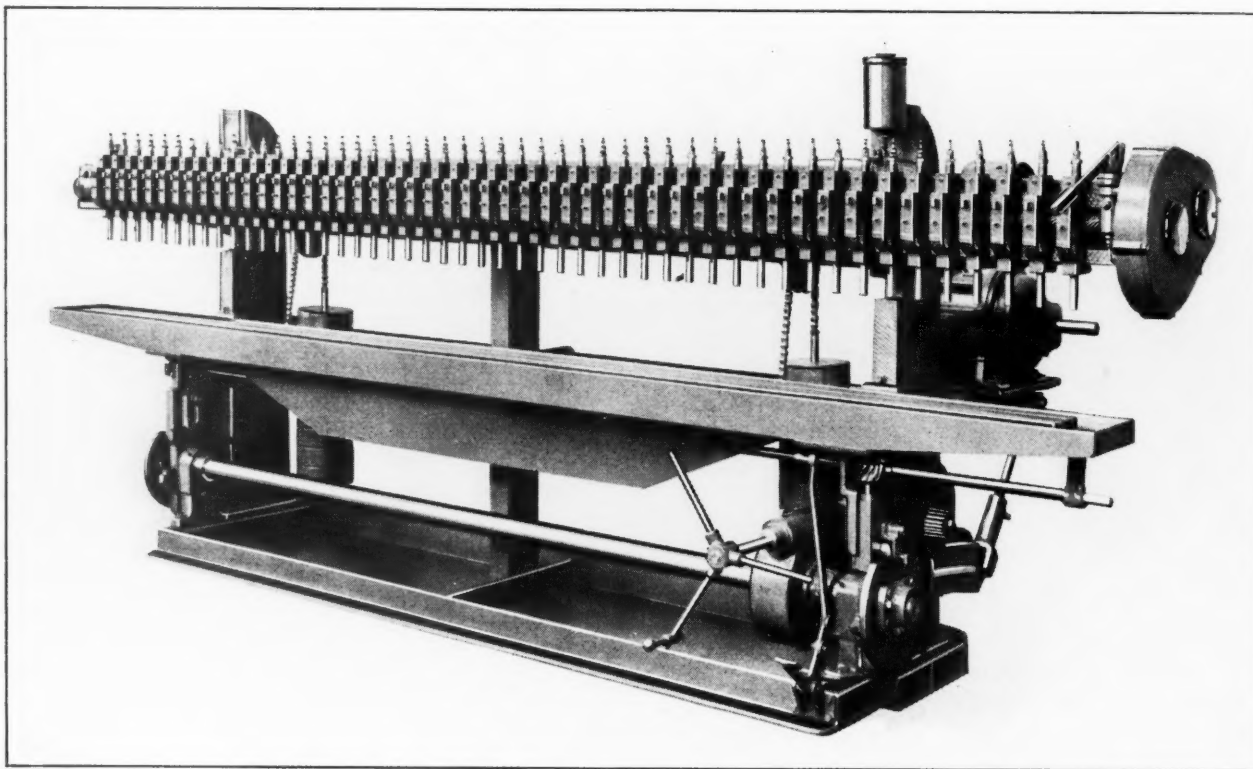


Fig. 4. Drilling Machine of Welded Construction Having Forty-nine Spindles

still in its infancy, there is no doubt that it will be extended considerably as the users become more familiar with it. It is a question, however, as to whether this method is desirable in cases of high production

When the pattern cost is absorbed by a larger number of pieces, it is undoubtedly desirable to use cast iron in many instances. However, the writer believes that for special machine tools, jigs, and fixtures, the welded construction is quicker and cheaper. As

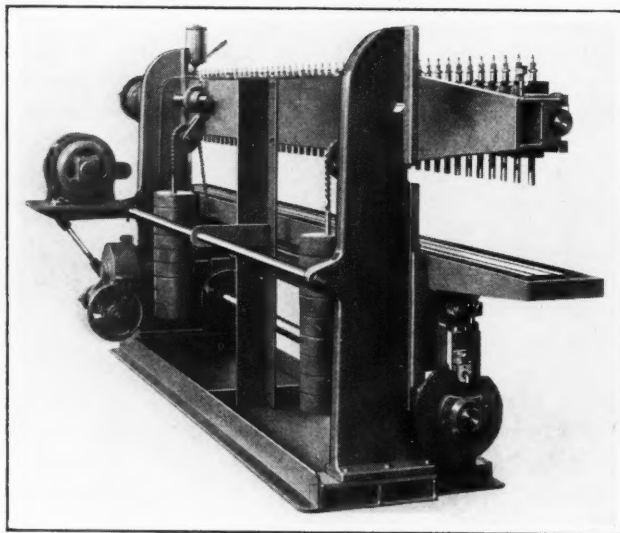


Fig. 5. Rear View of Machine Shown in Fig. 4

will build and request machines to be built by welding in the future.

* * *

Two completely arc-welded gantry cranes have been built for the National Terminal Co. in Cleveland. Only where interchangeability of parts is required are bolts used. The cranes are of 5-ton capacity, mounted over a 32-foot span. They were designed by the Orton Crane & Shovel Co., and erected with Lincoln welding equipment.

Fabricating Stainless Steel

At a recent meeting of the Indiana Section of the Society of Automotive Engineers, C. C. Snyder, metallurgist with the Republic Steel Corporation, Massillon, Ohio, outlined successful methods for welding, drawing, and finishing stainless steel sheet metal. He pointed out that a widely used type of non-corroding steel alloy is that known as the 18-8 or Krupp Nirosa KA-2 steel. This material has remarkable ductility after heat-treating at a temperature of approximately 2000 to 2100 degrees F. While it work-hardens rapidly, subsequent high-temperature annealing will remove all cold-working strains and soften the metal so that further deep drawing is possible.

Stainless steels of the 18-8 class are readily welded by the spot, resistance, arc and acetylene

pose. If annealing must be resorted to in order to finish the draw, the lubricant should be cleaned off first, as some lubricants will dot the surface of the material. The annealing temperature should be about 2000 degrees F. for best ductility, and the metal must be cooled rapidly afterward.

A pickling solution containing 8 per cent of sulphuric acid and 2 per cent of hydrochloric acid has been found to be best for this material. This should be followed by a 20 per cent nitric-acid bath, to give a white pickled finish and maximum resistance to corrosion. The pickling temperature should be from 130 to 160 degrees F. The acid percentages are by volume.

Finishing Stainless Steel

The surface condition of the material determines the grit that should be used at first in polishing.

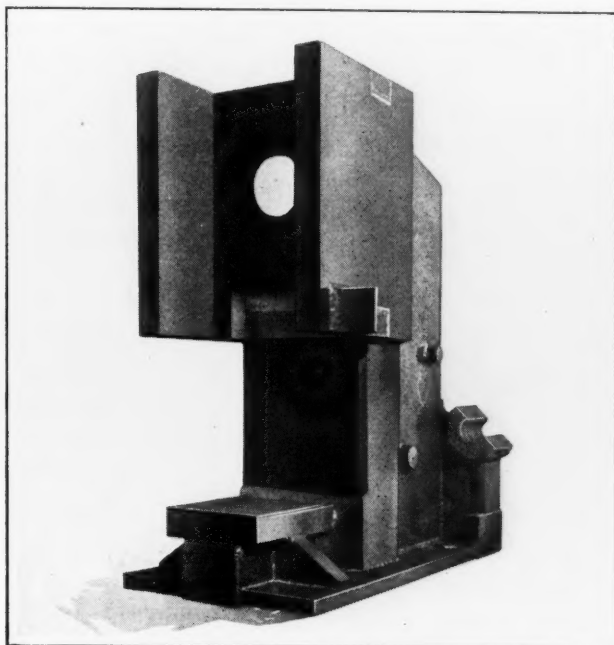


Fig. 6. Arc-welded Housing Weighing 31,500 Pounds for Machine Shown in Fig. 7

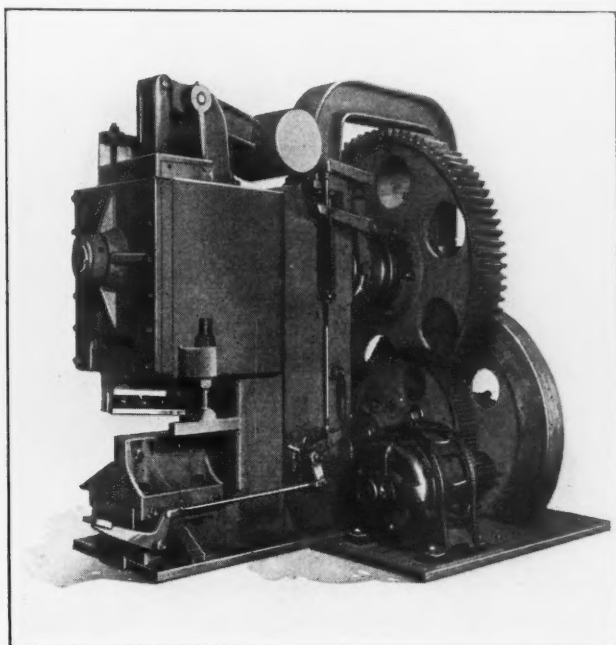


Fig. 7. A 2 1/2 by 20-inch Monitor Shear of Arc-welded Construction

methods. The welds are tough and resist corrosion well, and no heat-treatment is required except for protection against severe corrosion conditions. A low-carbon KA-2S welding rod should be used.

This alloy is used extensively to resist all types of corrosion. The maximum temperature for oxidation or scaling is 1600 degrees F. The alloy should not be used for alternate heating and cooling. In the presence of sulphur gases, the 18-8 alloy should not be used at temperatures higher than 1200 degrees F.

Drawing Sheet-Metal Parts

Specially developed lubricants are advised for drawing 18-8 sheets. One of the most popular of these is a mixture of lithopone and linseed oil, to which chalk and sulphur are sometimes added. Nearly all manufacturers of lubricants are now selling compounds that are suitable for the pur-

A manufactured abrasive having a grit of 150 to 180 is recommended ordinarily for 18-8 sheets. This should be followed by 200 emery, 240 flour, and buffing with an alumina buffing compound. A light buff with chromium-oxide stick is recommended for coloring. The direction of polishing should be changed at each wheel, if the shape of the work permits, to remove the polishing lines left by the previous wheel. A curved shape such as a lamp shell should be rotated against the wheel as it is polished.

* * *

Index to MACHINERY

The annual index to MACHINERY covering Volume 37 (September, 1930, to August, 1931) is ready for distribution. Copies will be sent, upon request, to readers who keep a file of MACHINERY.

Reverse Drawing of Conical Shells

Turning the Shell Inside Out in the Final Operation Eliminated Two Draws and Produced a Smooth Surface

By PAUL HOMER WHITE

STRAIGHT drawing in a power press usually presents little difficulty. However, although certain metals can be drawn satisfactorily in this way, other metals may show better results by reversing the draw. This is not always apparent, and in most cases must be determined by experiment.

Deep Conical Shell is Produced in Only Two Draws

The conical shaped shell *B* shown in Fig. 1 is a good example of a part formed by reversing the direction of the draw. Previously, four drawing dies of the usual type were required to make this shell, but by using the reverse method of drawing, the shell was completed in two draws. This, as

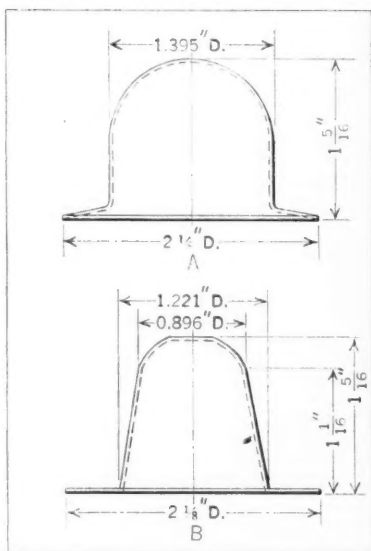


Fig. 1. Shells Drawn in Dies Shown in Figs. 2 and 3

can be readily seen, is a difficult drawing operation, inasmuch as the depth of the shell is somewhat greater than its largest diameter. The material used is a dead soft, cold-rolled drawing stock, 0.030 inch thick.

In the first operation, the shell is blanked and formed during one stroke of the press in the die illustrated in Fig. 2. Incidentally, many of the details in both the dies to be described are not shown, as the intention is merely to illustrate the general principles of construction.

As the ram of the press descends, the punch *B* enters the die *C* and cuts the blank. At this point, the blank is gripped firmly between the sloping faces of

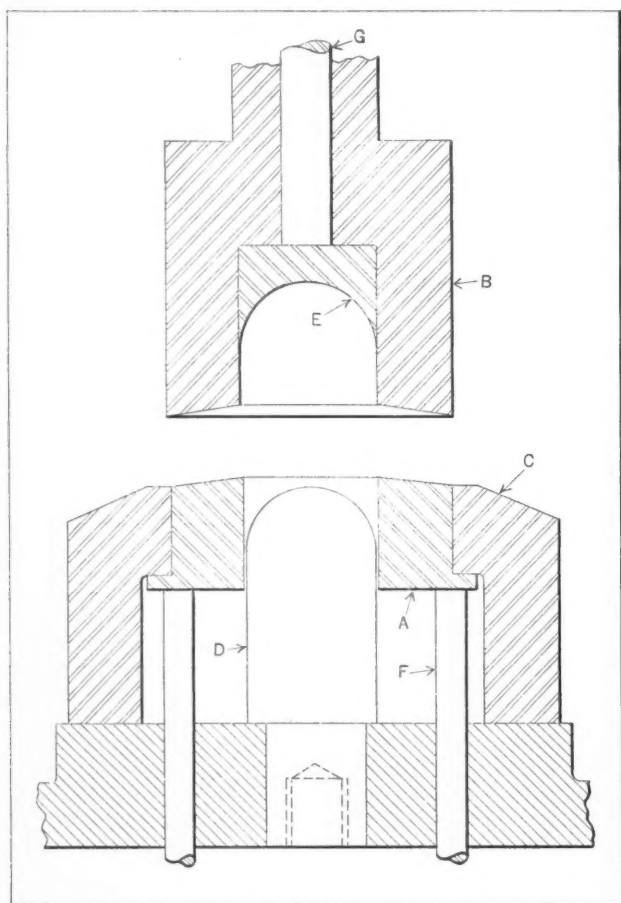


Fig. 2. Die that Draws Blank to Shape Shown at A, Fig. 1

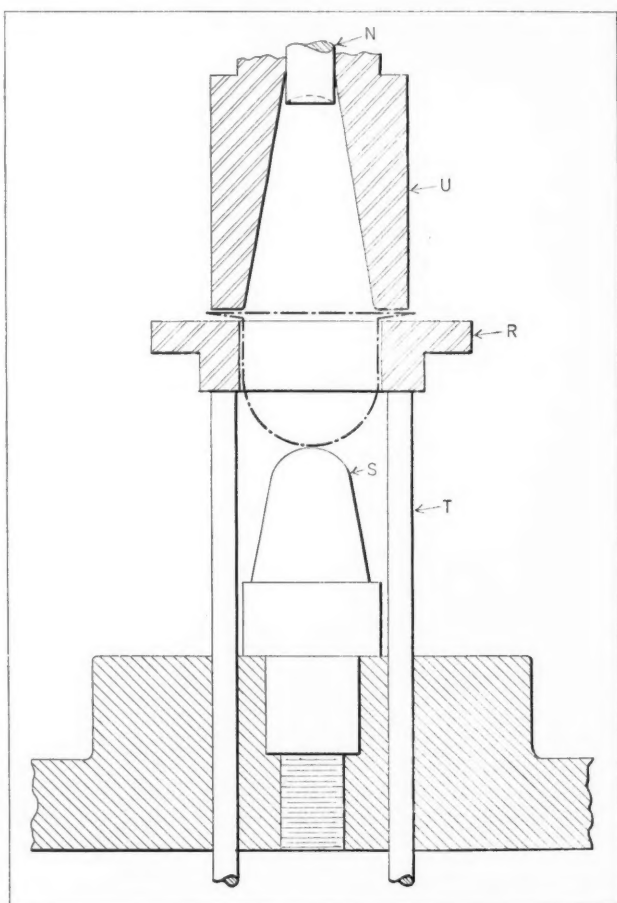


Fig. 3. Reverse Die that Turns the Shell Inside Out

punch *B* and pressure-pad *A*, the latter being held normally in its upper position by pins *F*. These pins are actuated by coil springs (not shown), which can be adjusted to vary the pressure of the pad *A* against the blank.

As the ram continues its downward movement, the blank is forced over the round end of the plug *D* and into a corresponding recess in the punch. The knock-out *E* is free to slide in the punch, and when seated, forms a continuous curved surface corresponding to the outside of the formed shell.

On the upward stroke of the ram, the pressure-pad follows the punch until the shell is stripped from the plug, and just before the top of the stroke has been reached, the knock-out pin *G* comes in contact with the cross-bar in the ram and forces the shell out of the punch. It will be noted that the die *C* is counterbored to limit the movement of the pressure-pad.

Turning the Shell Inside Out

For the second and final drawing operation, the piece is transferred to the die shown in Fig. 3. The flange of the shell rests on the pressure-ring *R*. This ring is guided in its vertical travel by four pressure-pins *T*, which are actuated by springs. The die *U* is hollowed out to correspond with the outside dimensions of the finished shell, except that the sloping sides are continued until they meet the opening for the knock-out pin *N*. When the ram descends, the flange of the shell is gripped between members *R* and *U* and the shell is carried down against the forming plug *S*. Continued downward movement folds the shell over the plug until, at the end of the travel, the upper die has closed down over the now conical shaped shell. Thus the shell, as first placed in the die, has been turned completely inside out. On the upward stroke of the press ram, the finished piece is ejected by the knock-out pin *N*.

Thirty thousand of these shells have been made in the two dies described, and the results have proved so satisfactory that it is planned to have all future orders on these parts handled in the same way.

* * *

It is stated in an article in the *Bureau of Standards Journal of Research* that unlapped chromium-plated plug gages showed considerably lower resistance to wear than lapped gages. The resistance to wear of the unlapped gages decreased as the thickness of the chromium plate was increased.

Nickel-Chromium Heat-Resisting Alloys

The nickel-chromium heat-resisting alloys play a vital part in industry. They are used in various automatic furnaces, the conveyor parts being largely made of these alloys. The chemical analyses of these parts vary over quite a wide range, depending on the particular class of service. For carburizing boxes, the high-nickel alloys running from 60 to 80 per cent nickel, combined with 15 to 20 per cent chromium, probably predominate.

On furnace parts, the range of nickel is generally between 30 and 40 per cent in combination with 15 to 20 per cent of chromium. The fabricated pots of sheet heat-resisting metal, or a combination of castings and sheet metal, have been gaining favor due to the lower weight of such construction. A

common analysis of the sheet metal used for this purpose shows that the metal contains from 25 to 27 per cent of nickel and 16 to 18 per cent of chromium.

Other uses of nickel in the heat-treating room are in the thermocouples, where nickel-chrome-iron or nickel-copper, or nickel-aluminum alloys are used, depending on the temperature requirements. Pure nickel has been used in the hardening room for pyrometer protector tubes of high-speed steel furnaces. It has also been used as a hearth block for the hardening of high-speed steel, as well as for containers employed in hardening wire

size drills and various other small tools.

* * *

Wood-Turning Lathe Equipped for Sanding

By FREDERICK LEU

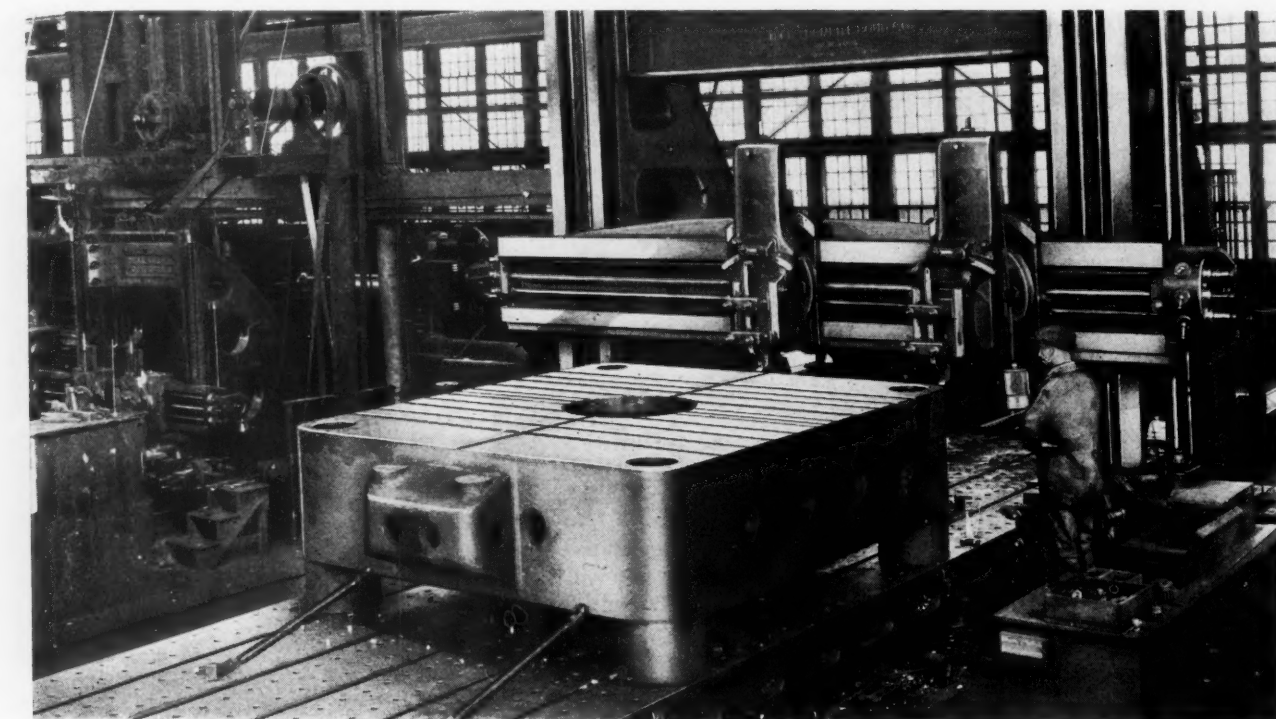
As a substitute for a sanding machine, one pattern shop employs a wood-turning lathe equipped with a faceplate on which a sandpaper disk is glued. When the disk is worn out, the plate is submerged in water for a short time, after which the worn disk can be peeled off. The plate can then be washed clean and a new disk glued in place.

Proper provision is made for supporting the work by means of a plate, about 6 inches square and 3/8 inch thick having a shank that fits the tool-rest of the machine. To produce draft on a pattern, the tool-rest is blocked up the required amount at one end. If a more permanent arrangement is desired, the table may be hinged to its shank so that it can be set quickly to the required angle.

Notes and Comment on Engineering Topics

A study made by the inspection department of the American Mutual Alliance, 2200 Lake Michigan Bldg., Chicago, Ill., indicates that the average damage to tall factory chimneys equipped with lightning rods is less than one-tenth of that to chimneys not so equipped. Hence, while lightning rods are not an absolute safeguard, they reduce the probability of heavy damage to a great extent. It is ad-

vised that conductors should be of copper and should have ample carrying capacity. When tape is used, it should not be smaller than 1 by 3/32 inch. Chimneys less than 60 feet high should preferably have two rods, while higher chimneys should always have two rods or more. An efficient ground at the lower end of the rods is important. The best and generally most convenient ground is an underground water main; but when this is not available, buried copper plates may be used.



Machining the Follower Platen of a 1500-ton Hydraulic Press on a 12- by 38-foot Planer at the Farrel-Birmingham Co.'s Plant in Buffalo

vised that conductors should be of copper and should have ample carrying capacity. When tape is used, it should not be smaller than 1 by 3/32 inch. Chimneys less than 60 feet high should preferably have two rods, while higher chimneys should always have two rods or more. An efficient ground at the lower end of the rods is important. The best and generally most convenient ground is an underground water main; but when this is not available, buried copper plates may be used.

As with many other so-called innovations, the advent of the rear-engined automobile is not so new as it seems. In the beginning of the industry, says the historical department of the Society of Automotive Engineers, the engine was frequently put in

the rear of the car or under the back seat. In the early roadsters it was made readily accessible by the mere lifting of the rear deck or the opening of the body tail gate. Single-cylinder engines were mounted this way so that the spark plug and carburetor could be easily reached. Then came the double-opposed engine, the rear cylinder occupying the usual position while the opposing cylinder

extended forward horizontally under the body. Nor is free-wheeling a new idea, even for automobiles. The "coaster brake" bicycle was its prototype, but it was

also introduced in some automobiles in Europe years ago.

Engineers and artists have gone into partnership in the design and construction of the electrical equipment of the control room of the Harding Street power station of the Indianapolis Power & Light Co. Bright colors have been freely used, and the apparatus and equipment have been so designed that the control room has the appearance of an attractive office lobby. To indicate the care with which every detail was designed, it might be mentioned that more than twenty designs for the min-

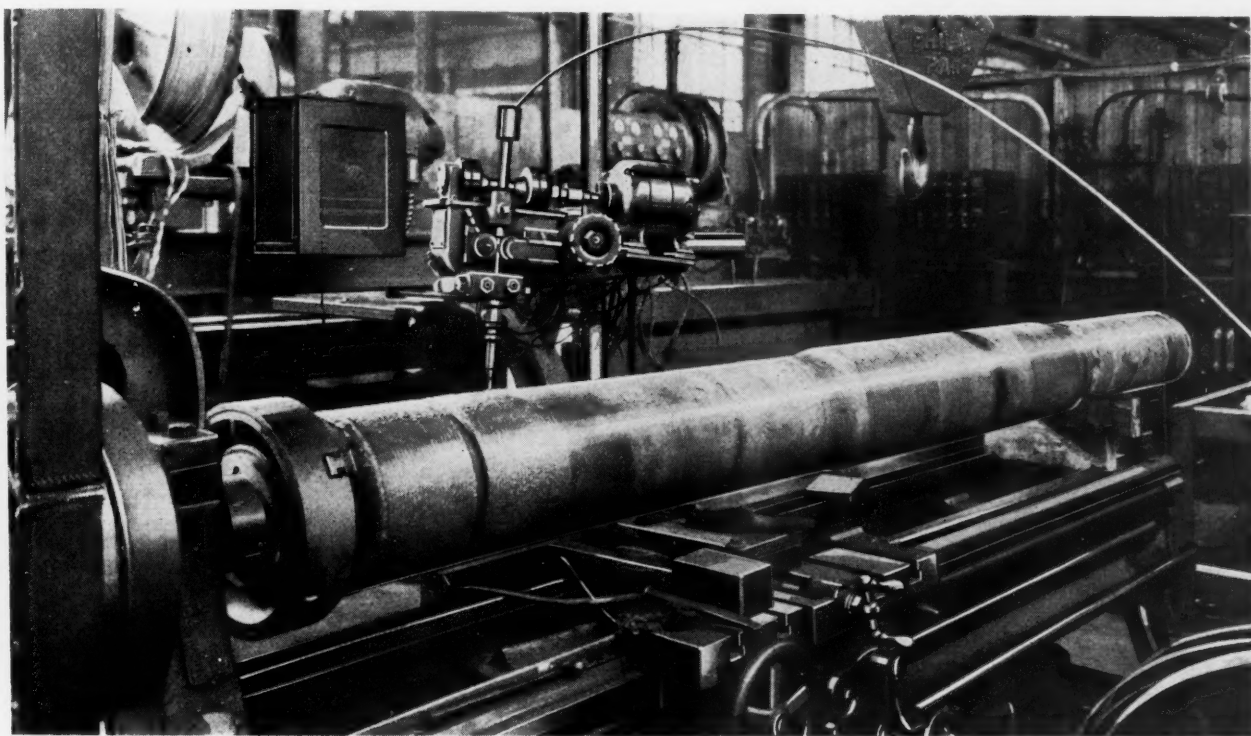
ature control switches were fashioned out of steel, hard rubber, and clay before an approved model was evolved for use on the control desk. Similar attention was given to the electrical and mechanical details of the entire equipment.

It has generally been believed that the earliest observer of the decalescence phenomenon in the heating of steel was a Russian by the name of Chernoff, who, about 1860, called attention to this characteristic of steel when heated. It has since been ascertained, however, that this property in steel was discovered at a much earlier date.

In a publication issued in 1778 in Sweden, an article appeared on the hardening of steel, written by

a definite scientific study of the phenomenon. The practical value of his observations were finally laid down by Brinell, the Swedish metallurgist, who developed the Brinell hardness testing method.

When the reversing planer motor was first made use of, it was simply applied to regular planer designs without any change except the removal of the tight and loose pulleys. Nevertheless, the application of the motor was a decided improvement, as cutting speeds as low as 25 feet per minute were available for machining hard materials, and speeds of 50 feet per minute, with return speeds as high as 100 feet per minute, could be used when required. Later, improvements in cutting tools called for still



J. F. Angerstein, in which the author mentioned that he had observed a means whereby the correct hardening temperature for steel could be accurately determined.

He pointed out that at the right hardening temperature, there is a sudden shadow or change of brightness in the object being heated. This shadow is evidently caused by the temperature reduction which takes place when the steel passes the decalescence point.

It was not possible for the early observer to understand the reason for the loss of brightness in the heated steel, but he pointed out that this was the point when the right hardening temperature had been reached and by observing it, he was able to harden at a temperature determined by the same principle as is employed in modern means of determining the decalescence point. Chernoff made

Worn 10-inch Shaft for Paper Mill
Grinder Rebuilt by Automatic Arc
Welding at the General Electric Co.'s
Plant in Schenectady, N. Y.

greater speeds, and the cutting speeds were stepped up to 75 feet with a return speed of 120 feet.

Still greater improvements in cutting tools made it desirable to design planers for a minimum speed of 30 feet per minute and a maximum speed of 180 feet per minute, with a return speed of 210 feet per minute. Constant-voltage electric motor drives are used on machines built for these speeds.

According to recent statistics compiled by the Bureau of the Census, the value of the manufactured products of the United States in 1929 exceeded \$70,000,000,000. More than half of this output was manufactured in the states of New York, Pennsylvania, Illinois, Ohio, Michigan, and New Jersey.

EDITORIAL COMMENT

In view of the remarkable improvements that have been made in gear-cutting machinery during the last twenty-five years, it is surprising to learn that machines built "during the past century" are

Machines Built During the Past Century Make Profits Elusive

still in use for cutting gears. The manufacturer of a well-known line of gear-cutting machines recently received a letter from a shop that wanted to obtain repair parts for a machine built in 1894—thirty-seven years ago. Another machine sold by the same company to a manufacturer in Ohio in 1896 later found its way into New England as a second-hand machine and is still used for cutting gears—how efficiently may be left to the imagination. Gear-cutting machines over twenty-five years old are still being sold by second-hand dealers. Why these old machines are being bought is a puzzle to users of up-to-date gear-cutting machines who know, through their own experience, how much time and money are saved by the improved machines.

The twentieth annual Safety Congress and Exposition, held under the auspices of the National Safety Council in Chicago last month, demonstrated the tremendous progress that has been made in the application of safety appliances and the promotion of safe working conditions in the last twenty years. This movement was first started by

Safety Engineering No Longer Needs an Apology

a number of enthusiastic engineers who felt that the loss of life and limb in industry, due to preventable accidents, was a matter that called for increasing attention on the part of management. They appeared to think, however, that it would not be quite the thing for an engineer to place a matter of this kind on a purely humanitarian basis; so they constantly emphasized the fact that the elimination of accidents would result in great economic savings to industry.

Of course, they were correct in this assertion. As in so many other instances, the right thing to do is also the profitable thing to do in business, and the welfare of the employees did not have to be bought by any diminishing profits to management. On the contrary, the two have gone hand in hand. No safety engineer today needs to make any apologies for the expenses connected with the safety movement, because these expenditures have been returned with interest to management; at the same

time, they have increased human happiness and well-being.

Today, the position of the safety engineer is assured; that he has filled his place to the satisfaction of management was amply evidenced at the Safety Congress.

A manufacturer making a very high-grade product in the machinery field specifies to his customers the kind of lubricating oil that should be used in connection with his device. The oil specified is of the highest quality, calculated to reduce repairs and maintenance cost to a minimum. Wise customers follow the specifications suggested in buying their lubricating oils.

It Is One Thing to Give Advice, Another to Follow It

When the same manufacturer buys lubricating oils for the machinery in his own plant, for which approximately the same kind of lubrication is required, he does not follow the specifications given to his customers. Instead, he buys strictly on price, using oils that cost but one-half as much as the high-grade oil that he recommends to his customers. The advice that he gives his customers is good; he saves them expense for maintenance and repairs. But he is willing to assume high maintenance and repair costs in his own plant, due to the use of inferior lubrication.

It has often been pointed out in *MACHINERY* that it is false economy to buy the very best types of machine tools and operate them with inferior tooling equipment. It is also false economy to buy high-grade machines and tools and let them age prematurely because of inferior lubrication.

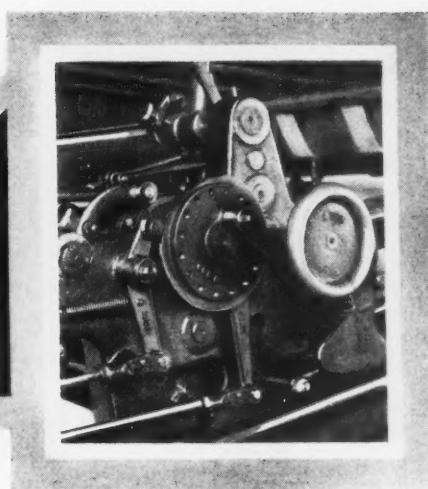
Improved machinery has never caused unemployment; it has merely reduced the effort required to produce goods. As a result, it has lowered costs and made available the products of labor—that is the comforts of life—to an ever increasing number of people.

Blaming the Machine for Our Ignorance of Economics

Unemployment has no relation to improved machinery. If our knowledge of economics is so limited that we do not know how to keep the improved machine busy producing the goods it was designed to make, we should not blame the machine. Our failure to understand economics is no reason for condemning engineering.



Ingenious Mechanical Movements



Planetary Intermittent Gearing

By J. E. FENNO

Intermittent gearing of the planetary type may be used to advantage in cases where the driving and driven shafts must be in line with each other, and where a large number of dwells per revolution of the driven shaft is required. A drive of this type is shown in the accompanying illustration.

The ring gear *A* is stationary, and the single-tooth gear *B* is driven by means of the shaft *C* through the gears *D* and *E*. Gear *D* is keyed to shaft *C*, while gear *E* is integral with gear *B*. Both gears *E* and *B* are free to turn on the shaft *J*, mounted in the arms *F* and *G*. A hub on the lower end of arm *F* turns freely in the stationary bearing *H*, the intermittent movement being taken from this hub. Gears *D*, *E*, and *B*, in this case, have the same pitch and pitch diameters; hence, according to the principles of epicyclic gearing, one-third of a revolution of shaft *C* is required to index the arm *F* one division.

In the position shown, the single tooth in gear *B* is about to engage a tooth space in the ring gear. As soon as this engagement occurs, arms *F* and *G* will start to rotate on shaft *C* in a counter-clockwise direction. Rotation of the arms continues until the single tooth has left the tooth space,

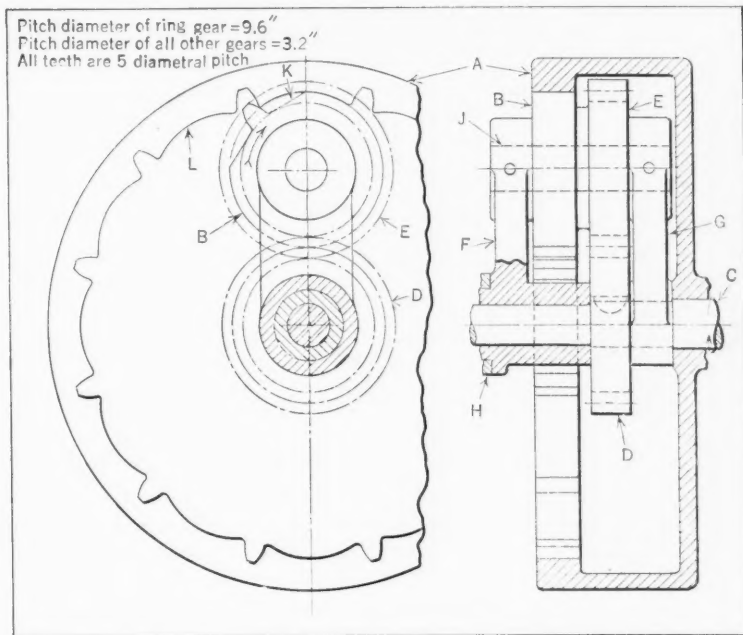
at which time the concentric portion of gear *B* engages the corresponding cylindrical surface *L* in the ring gear, locking gear *B* and causing arms *F* and *G* to dwell. The arms continue to dwell until the tooth in gear *B* has engaged the next tooth space in the ring gear, which causes the arms to move toward their next dwelling position. In designing the single-tooth gear *B*, sufficient clearance should be provided, as indicated, at *K*; otherwise, interference with the ring gear will result.

* * *

Hopper Attachment for Feeding all Shells with Their Closed Ends Up

By F. E. JUDSON

Regardless of whether shells are fed from a hopper with the closed end at the top or at the bottom, the attachment shown in the illustration will deliver them to the press dial with the closed end at the top. This device greatly simplifies the design of the hopper, inasmuch as no attention need be paid to the position in which the shell leaves the hopper opening. By modifying the design of the attachment shown, the shells may also be delivered to the dial with the closed end at the bottom. Hence, by constructing two demountable attachments, shells may



Intermittent Gearing of Planetary Type

be made to enter the dial with the closed end at the top or at the bottom, only one hopper being employed in both cases.

The shells are fed from the hopper into the tube A. From the tube, they drop into openings in the annular ring B, which is given an intermittent rotary motion by means of the ratchet wheel C and ratchet lever D. This lever is given an oscillating movement through the link E which is carried in the press ram; and for every cycle of the ram, the ring B is rotated one division.

If all the shells were to drop into the ring in the position indicated at F, they would drop out of the lower end of this ring in the proper position to enter the press dial G. But when a hopper of the design mentioned is employed, the shells can take the position shown as they pass down into the tube A. Hence, provision must be made for delivering all the shells to the press dial with the closed end at the top.

It is obvious that the shell G must be inverted before it reaches the dial. Instead of the shell being carried around with the ring, however, it will be forced down through a hole in the stationary core H

by means of the plunger K secured to the press ram; and from there it will pass once more through the ring and into the tube J.

When a shell in the position indicated at F is indexed to the top of the ring, it will not pass down through the core H, as the plunger K will simply enter it without making contact. The shells are prevented from dropping by gravity at the top of the ring by a spring (not shown) which bears against the side of each shell as it passes this point. The tube J is made long enough to contain six shells, or half the number that can be held in the ring B. This length of tube was necessary, as, with a shorter tube, it is possible for the shells to pile up and be carried around once more past the tube A.

The ring is operated through a friction disk from the ratchet wheel C, and the position of the holes in the ring, relative to the hole in the core H and the tube J, is governed by the downward movement of the lever D, which is limited by the stop L, secured to the base M of the device. The base, in turn, is securely fastened to the press bed. Lever D strikes stop L before the downward stroke of the press has been completed, link E sliding, against the pressure of a coil spring, in a projection on the press ram.

In case a damaged shell is indexed into position under plunger K, the plunger, instead of moving downward, will be held suspended, as it telescopes within the holder N, and the shell will be prevented from passing down into core H.

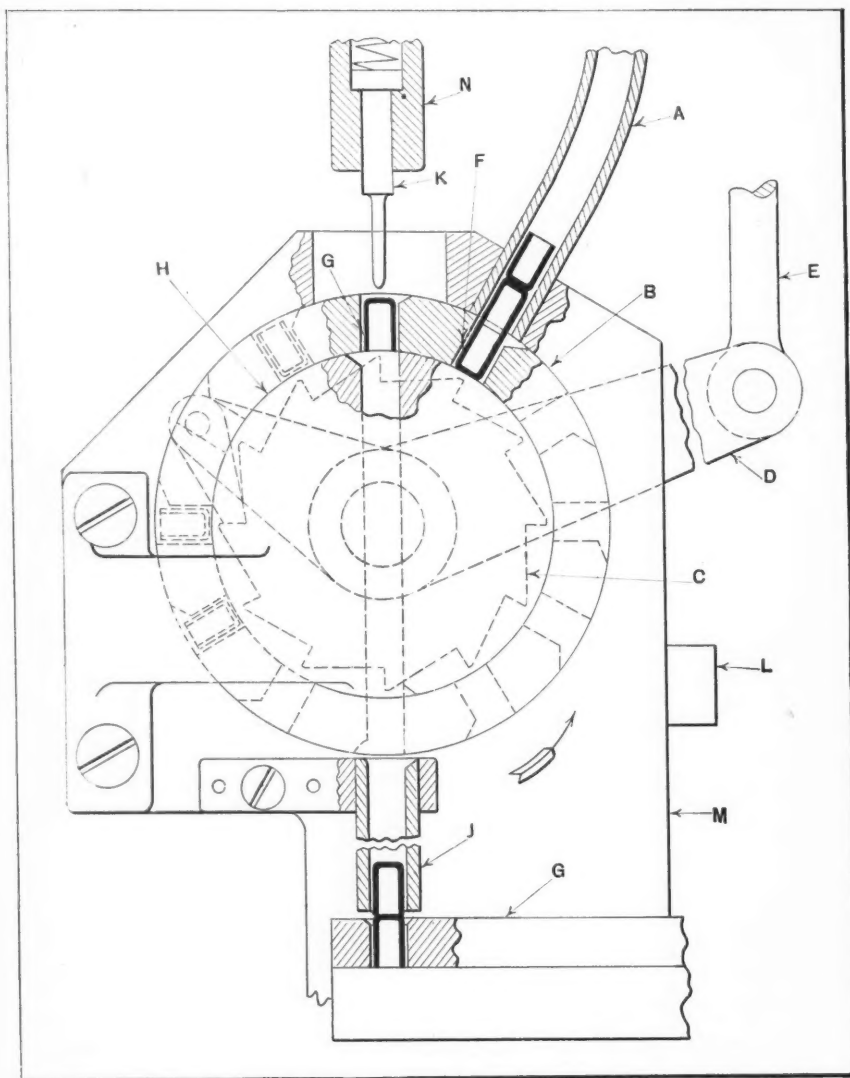
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Mechanism for Reversing Tap Spindles in Drill Head

By EDWARD HELLER

When more than one tap is used in a drill head, the problem of reversing the taps is often simplified by having one tapping spindle drive on the "in feed" and another spindle drive on the "return feed." The arrangement of the gearing for such a drive is shown diagrammatically in the accompanying illustration. In this case, the large drill head carries a number of drilling spindles (not shown in the illustration), in addition to the four tapping spindles, A, B, C, and D.

The drill head slides up and down on column E, being kept in alignment by an external projection that slides in a vertical track. The drive is obtained from a vertical shaft F at the end of which



Device for Feeding Shells into a Dial with their Closed Ends up Regardless of their Position as they Leave the Hopper

is keyed the pinion *G*. This pinion is in mesh with the gear *H* which drives the drilling and tapping spindles. The drive for the drill spindles is very simple and is not shown in the illustration. The drive for the tapping spindles begins with the clutch shaft *I*, which is driven from the gear *H* through the pinion *J*. The shaft *I* carries a sawtooth double clutch *K* which can be engaged with either the upper member *L* or the lower member *M*.

When the downward feed of the head begins, an arrangement of levers similar to the belt-operating mechanism on a planer causes the clutch *K* to engage the upper member *L*. The drive to the tapping spindles is then through the idler gear *N*, which is mounted on the top plate *O*, and thence to the gear *P* on the top of the tapping spindle *B*. The tapping spindle is then revolved in the direction required for tapping. The other three spindles *A*, *C*, and *D* are driven in the same direction through the idler gears *R* which are mounted on the bottom of the gear-case *Q*.

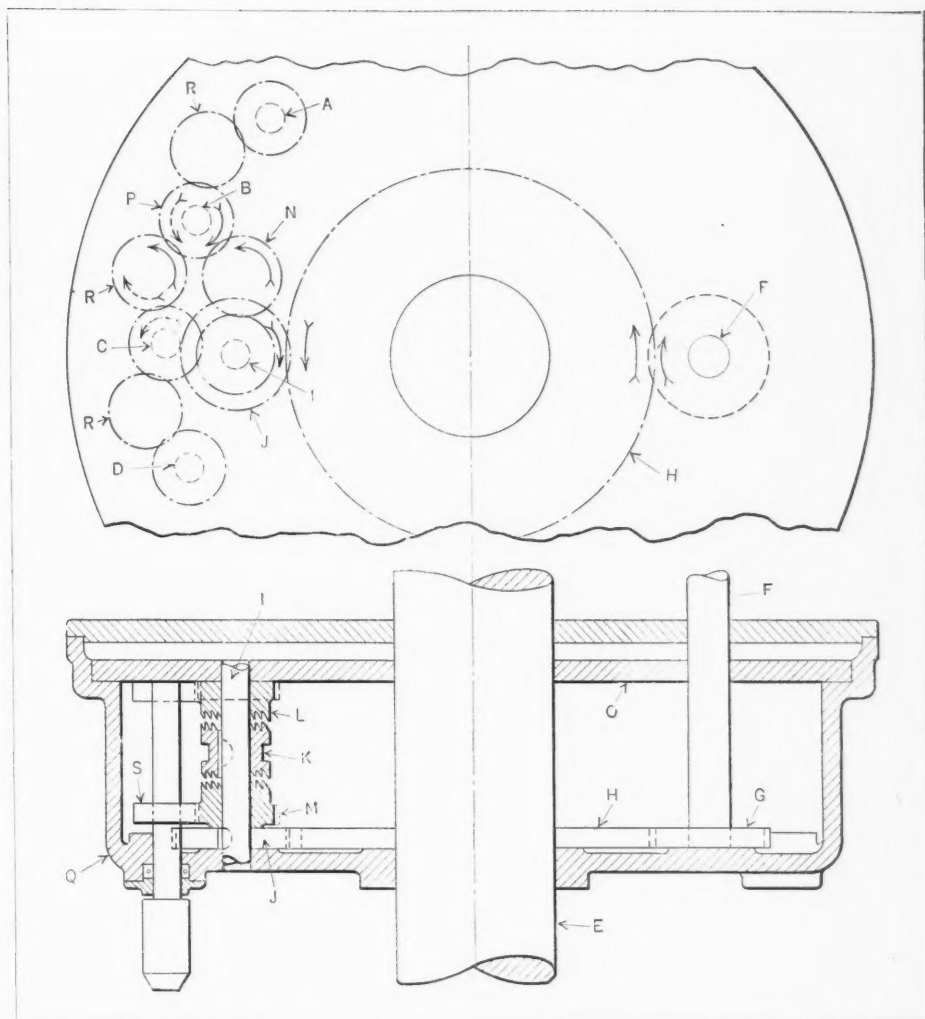
As soon as the head begins to travel upward, the clutch *K* comes into engagement with the lower clutch member *M* and drives directly through gear *S*, which is fastened to the bottom of the tapping spindle *C*, revolving it, together with the other spindles, in the opposite direction. The full-line arrow-heads show the direction in which the meshing gears revolve when tapping, while the dotted arrows indicate the direction in which the gears revolve when the spindles are reversed on the "out feed."

The information in the foregoing was obtained through the courtesy of A. C. Moberg, chief engineer of the Sommer & Adams Co., Cleveland, Ohio.

* * *

The Cheerful Side

Reports of the Steel Founders' Society of America, Inc., 420 Lexington Ave., New York City, show that the curve recording production and orders for steel castings, after having continuously dropped from March, showed a slight up turn in August, the last month for which complete reports are available.



Reversing Mechanism for Taps Used in Multiple-spindle Drill Head

Notes on Polishing Stainless Steel

By W. E. WARNER, Herts, England

Stainless steel can be polished to a mirror-like finish by using a fine-count cotton buffing wheel. This wheel should be operated at a surface speed of between 10,000 and 15,000 feet per minute. For an abrasive, the writer uses emery powder lubricated with tallow or lard oil, and for finishing cuts, Turkish emery in tallow or lard oil.

For the final polishing, tripoli powder can be used, finishing off with a dry cotton buffing wheel on which there is no abrasive or lubricant. Stainless steel is very hard; very little metal is removed during polishing, and it is impossible to cut out any deep scratches. Therefore, before the work goes to the polisher it must be accurately ground so that deep marks or scratches are removed. Polishing will remove any surface imperfections, and leave a mirror-like surface.

* * *

Twenty years ago alloy steels represented only 1 per cent of the entire steel output. Today, this figure has risen to 6 per cent.

The Shop Executive and His Problems

Superintendents and
Foremen are Invited
to Exchange Ideas on
Problems of Shop
Management and
Employee Relations

MANY manufacturers, after they have charged off part or all of the cost of a machine, believe that their manufacturing costs are exceptionally low because they are using machines that have little or no book value. Costs figured on this basis are likely to be deceptive.

One large concern known to the writer charges each department for all machines used, regardless of how old they are and regardless of whether they have been charged off the books or not. This gives an accurate machine cost for parts coming from the different departments. In many other concerns it seems to be customary, after the equipment has been charged off the books, not to charge the department for the equipment. This gives the management a false impression of what the parts actually cost; and as there is always a tendency to try to get something for nothing, the department head is inclined to continue the use of old and obsolete equipment in preference to asking for new machines, as the cost of the new machines would be charged against his department.

The actual cost of the product to the company, however, may be much greater when the old machines are used, because labor costs and other expenses may run much higher. It is poor business to give the foreman or superintendent an incentive to hold on to obsolete equipment. **OBSERVER**

How Should Foremen Handle Mistakes Made by Their Men?

Whenever a mistake is made in machining a piece in the shop, the foreman should investigate the set-up, look over the tools and equipment, see whether the drawings are correct, and determine whether the cause of the trouble is in the materials being used or in the instructions given. If the fault is with anyone else than the workman, he should be told so frankly. If, however, everything that is given to the man to work with is correct, he should be cautioned to be more careful. The costliness of the mistake should be pointed out to him, making it clear that the loss is not merely in his own wages, but also in the material spoiled, the cost of the time of the machine, and the possible delay in delivery schedules.

If a man continues to make mistakes, the foreman should endeavor to find the cause. There are other things to be considered than pure carelessness. If a man who has given good account of himself in the past, suddenly begins to make mistakes,

it is almost certain that something is on his mind; he may not be well, he may have financial or family troubles, or his mind may dwell on some real or imagined grievance against the firm. Whatever is on his mind may be the cause of his apparent carelessness. A foreman who has gained the confidence of the men in his department is able to find out what the real trouble is. Usually it can be removed by a little friendly assistance. **J. A. HONEGGER**

Give a Man a Chance to Look Ahead

Why is it that in these days, when one might think that anyone who is steadily employed would be content merely because of that fact, so many applications for work are received from men who have steady jobs? The reason, in nine cases out of ten, seems to be that the man who desires to make a change feels that there is no chance for advancement with his present employer. This is a bad state of affairs, both for the man and for the employer. The man may leave a job, which, had he stayed, would soon have led to a promotion; the employer may lose a good man at the very time when his training has placed him in line for promotion.

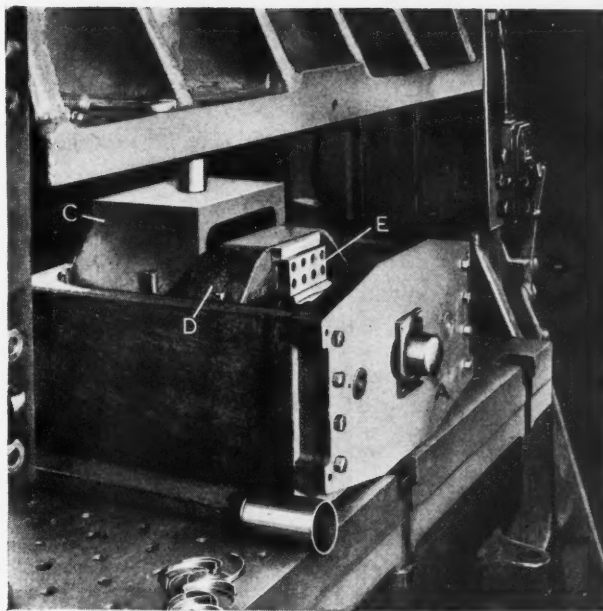
I believe that the cause of this trouble lies largely, on the one hand, with the employer who promises more than can be fulfilled, and on the other, with the employer who is too cautious in stating the prospects for advancement. The first one arouses hopes, which, when not fulfilled in a reasonable time, make the employe doubt his chances of promotion; the second, in trying not to make promises that he cannot live up to, is over-cautious and gives the employe an idea that there is practically no hope of advancement.

Frank discussions with men who are in line for promotion should be encouraged. Promotions that have been made in the past should be pointed out to the newcomers, so they will realize that if they make good and stay with the firm they will have their chance when an opportunity presents itself. I know of some large firms making use of this plan and have had a chance to see that it operates very successfully. The strongest organizations are those who promise only what can be kept, and who regularly promote men from within the organization. If other firms have similar plans, let us hear from them. **CHARLES R. WHITEHOUSE**

Dies for Trimming Steel Shells

Unusual Examples of Work Trimmed at a Rapid Rate by Means of a New Type of Die

By CHARLES M. BREHM, Engineer
The Steel Products Engineering Co.
Springfield, Ohio



THE article in a previous number of *MACHINERY* (September, 1931, page 12) describing how twenty-five square steel shells were trimmed per minute along all four edges in a single operation, introduced an entirely new type of die to *MACHINERY*'s readers. The present article will illustrate and describe additional examples of trimming dies operating upon the same general principles as the one formerly described. By modifications in the design of these dies, surplus stock can be trimmed from steel shells of almost any shape. The dies are so constructed that at a single stroke of the power press the trimming member is oscillated in several directions so as to trim the part complete. Typical trimmed parts are shown in Fig. 1. The dies are made by the Steel Products Engineering Co., Springfield, Ohio, under the Brehm patent.

In some cases where the shell has notches or projections along its edge or where one or more holes must be pierced close to the top, the notching or piercing can be combined with the trimming in one operation. The die shown in Fig. 2 was designed for piercing two holes in a radio-tube shield and simultaneously trimming the shield. Although this part is made of a light material, the same type of operation has been performed on heavier stock.

The die is illustrated with the press ram lowered to the point where

the trimming commences. Prior to the downward stroke of the ram, the work *A* is slipped into die *B* and seated on a block *C*. Then when the ram moves down, the gaging member *D* enters the shell and pushes it downward against the pressure exerted by a spring beneath block *C*, the result being that the shell is held firmly against the bottom of the gage. The shell is pushed down by the gaging member *D* until four stops *E* come in contact with the top of die-plate *B*. By this means, the trimmed height of the shell is controlled precisely.

Die-plate *B* is mounted on a square box *F*, which has cam surfaces on the four outer sides that engage four blocks *G*. The construction is such that as the press ram continues its downward movement after plugs *E* reach the position illustrated, the vertical movement of cam box *F* past blocks *G* causes the cam box and the entire lower die unit to move first to the right, then to the left, next to the back, and finally to the front. During these movements, the four edges of the shell are trimmed as they are pushed past the cutting edge of shearing member *H*.

The two small holes are also produced during the horizontal oscillations of the lower die unit by two punches *J*, which are held in blocks



Fig. 1. Parts of Many Different Shapes which are Trimmed by Means of Dies Similar to Those Described in this Article

fastened to the under side of the shearing member *H*. Punches *J* enter holes in two blocks such as illustrated at *K* and eject the slugs through these holes. It will be obvious that blocks *K* have no sidewise movement relative to member *H*, whereas the gaging member *D* slides with plate *B*. During the entire operation, the cam box *F* is supported by casting *L*, pressure being constantly exerted against the bottom of the cam box by four coil springs.

Upon the upward stroke of the press ram, a spring on the upper end of rod *M* forces this rod downward and locks gage *D* so that it cannot be

instance, to trim the shell seen at the side of the die, which is $4 \frac{7}{8}$ inches deep, a ram movement of about 13 inches would be required with the vertical type of die just described, whereas with the horizontal die employed, the ram stroke is only $2 \frac{1}{2}$ inches. Horizontal dies also facilitate the loading of long pieces. In the present example the work *A*, Fig. 3, is merely slipped on the gaging member *B*, there being no in and out movement of the gaging member during the trimming operation.

It will be apparent from the heading illustration that the shank on top of casting *C* enters a hole in the press slide, and that the bottom of the slide normally rests on top of casting *C*. This casting has an angular face which acts as a wedge against a corresponding surface of slide *D*. Thus for each inch of vertical movement imparted to casting *C* by the press, slide *D* is actuated horizontally a similar amount.

When the press slide descends and slide *D* is pushed forward, the movement of four blocks *E* over four cams *F*, Fig. 3, arranged in the form of a square box, causes the shearing die *G* to move consecutively to the right, to the left, upward, and downward so as to shear the tube around the complete circumference of the open end. The scrap is cut into two pieces and falls clear of the trimming die.

Gage *B* is attached to the trimming die *G* in a floating manner, so that it remains stationary during the operation, even though the trimming die oscillates as described. It will be seen from Fig. 3, which is a sectional plan view of the equipment, that slide *D* is piloted by two heavy bars *H* which enter bushings in the main housing of the unit.

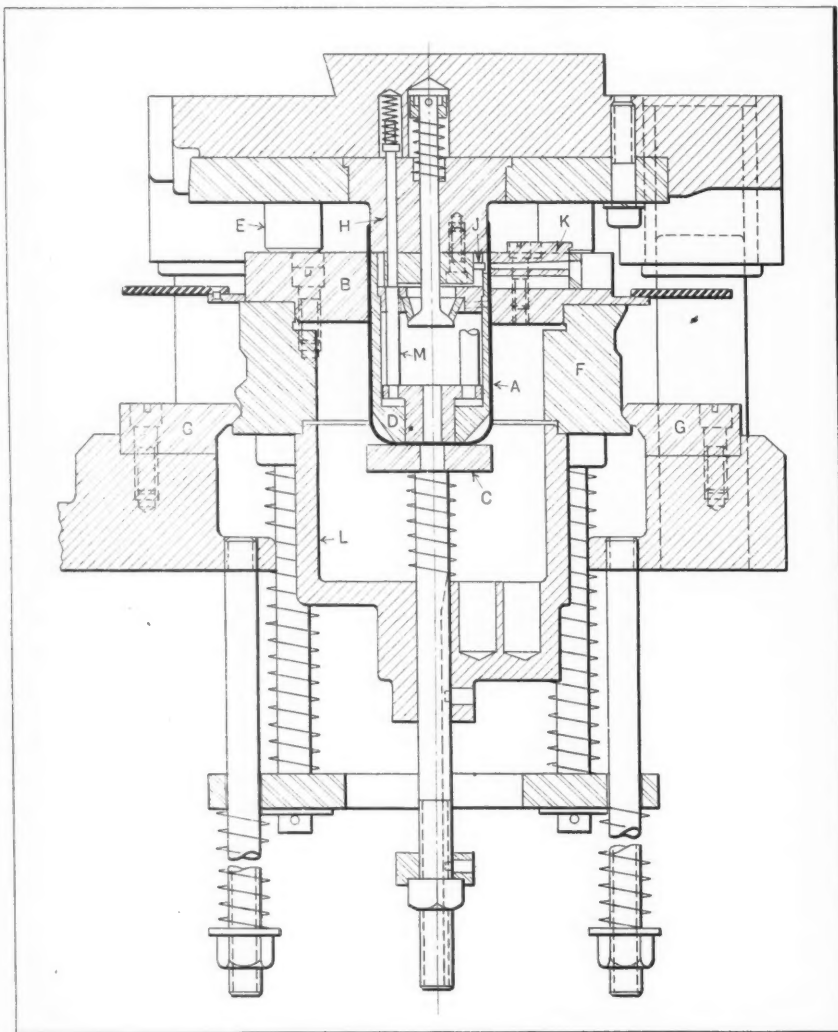


Fig. 2. Die Designed for Piercing Two Holes Near the Top of Radio-tube Shields at the Same Time that the Part is Being Trimmed

accidentally pushed from its proper position when the work is being loaded into the die.

Dies of Horizontal Construction Desirable for Long Pieces

When shells to be trimmed are longer than $1 \frac{1}{2}$ inches, it is generally preferable to employ a horizontal die, such as is shown in the heading illustration, in order to avoid an excessive ram stroke. For

Cylindrical Shell Trimmed at an Angle

Dies have also been made for trimming the edge of shells at some angle other than 90 degrees with respect to their sides. Fig. 4

illustrates a die designed to trim the cylindrical shell *A* at an angle of 35 degrees with the bottom. It will be noticed that the part is placed vertically in the lower die unit and that the faces of die-plate *B* and trimming die *C* are at the angle to which the part is to be trimmed. Gaging member *D* is loaded into the shell before the work is slipped into the die.

On the downward stroke of the press ram, the gaging member *D* pushes the shell against the

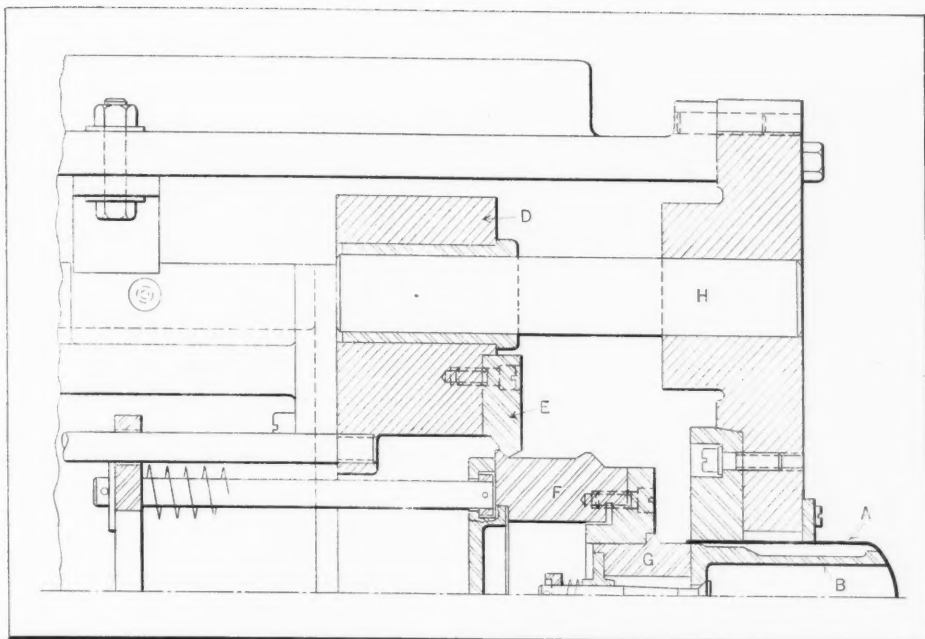


Fig. 3. Horizontal Type of Die which Enables Long Shells to be Trimmed with a Comparatively Short Vertical Movement of the Press Ram

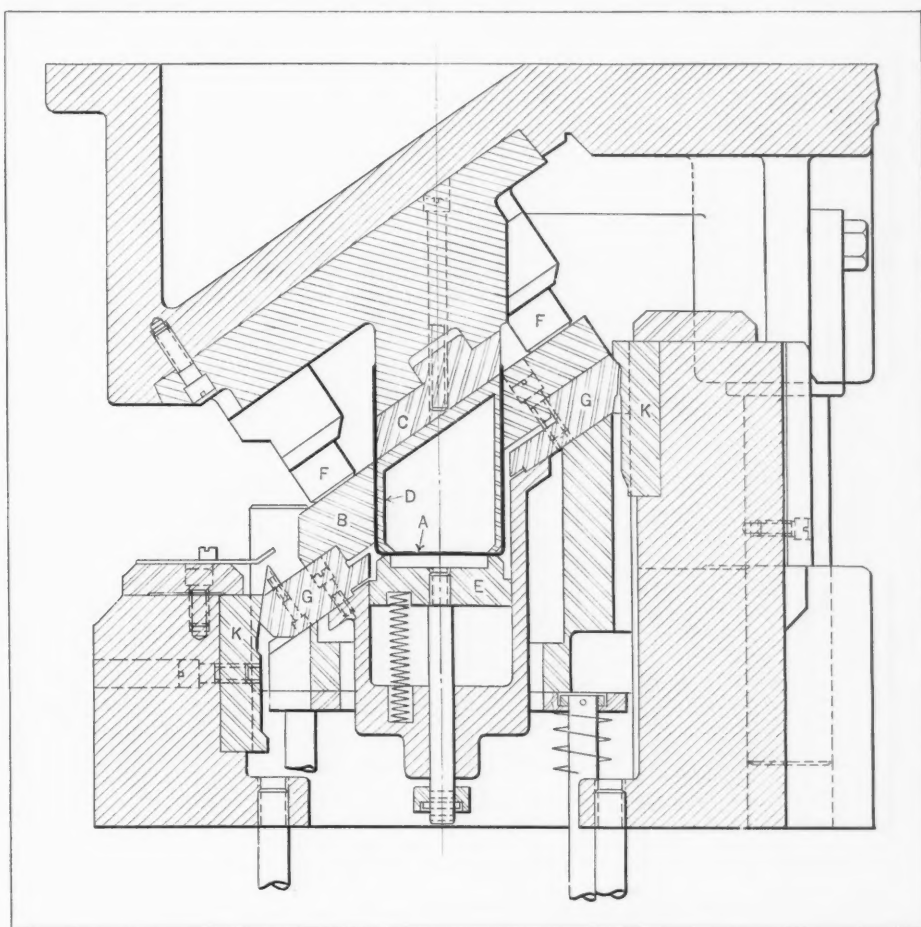
spring-backed buffer *E* until the four stops *F* touch the face of die-plate *B*. Then, as the ram continues to descend, blocks *G* on four sides of the die are lowered along the cam surfaces of four blocks *K*, thus causing die-plate *B*, together with the gaging member *D*, to be oscillated at an angle of 35 degrees. Die-plate *B* moves toward the front, back, right, and left.

As the gaging member *D* is separate from the upper die unit, shells of different lengths can be handled by merely substituting gages of corresponding lengths.

* * *

When posterity looks back upon our era, shall it be said that we showed remarkable intelligence in constructing machinery, but did not seem to know how to keep it running continuously, producing the goods we all would like to use for our comfort and enjoyment?

Fig. 4. Trimming Die that Shears Excess Stock from Cylindrical Shells at an Angle of 35 Degrees



Scaling Photostats

By A. W. EIDMAN

Scaling photostats to obtain the approximate dimensions when the original drawing is not available is usually difficult, especially when the reduction does not conform to a standard scale. This difficulty could be easily overcome, if, in making the photostat, the draftsman's scale used in making the drawing were laid on the drawing. The scale to which the photostat is made would then be recorded directly on the print. This reproduction of the scale could then be used for scaling any part of the photostat.

If the outline of a regular draftsman's scale is objectionable on the print,

paper scales may be used instead. These scales may be attached with rubber cement to the original drawing in any convenient position and removed later if required.

Tapping Formed Parts in the Strip to Avoid Hand Feeding

The Parts Do Not Leave the Strip until after the Final Operation, when they Are Automatically Ejected

By J. E. FENNO

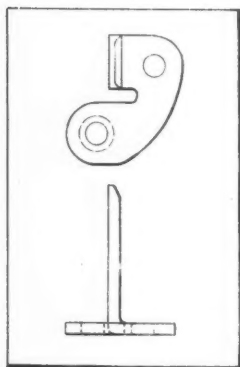


Fig. 1. Part Tapped before it Leaves Strip

THE proper arrangement of the sequence of operations on parts formed in a power press often eliminates a good deal of individual handling and thus serves to reduce substantially the production costs. The electric plug terminal illustrated in Fig. 1 is an example of a part to which this is particularly applicable.

Prior to the use of the tools to be described, this part was completed in three separate operations, namely, piercing and blanking, forming, and tapping. In the last two operations, the parts were fed to the machines by hand, but because of their peculiar shape they had a tendency to become interlocked with one another in the feeding trays, and a good deal of time was lost in unlocking them.

By replanning the entire job, the parts are retained in the strip from which they are made until all three of the operations are completed. In this way, individual handling of the parts is entirely eliminated, and considerable time is saved.

The first operation is that of piercing the holes and notching the side of the strip, as shown at A in Fig. 2. As the die used is of standard design, it will not be described. However, it may be well to

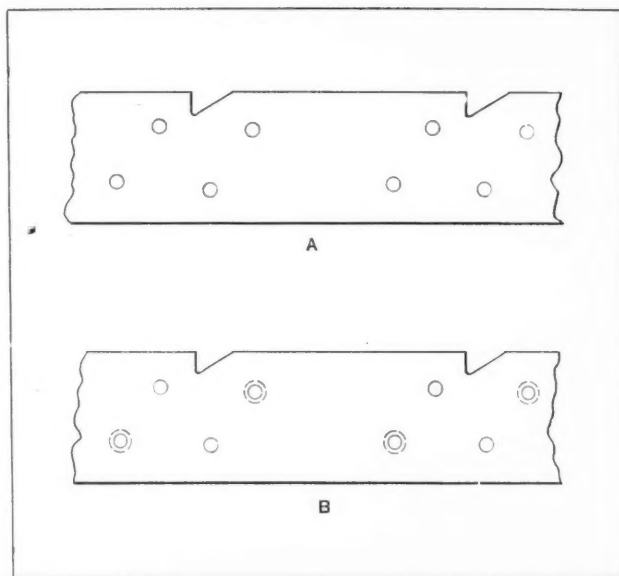


Fig. 2. Strip is First Pierced and Notched, as Indicated at A. It is then Tapped as Shown at B in the Set-up Illustrated in Fig. 3

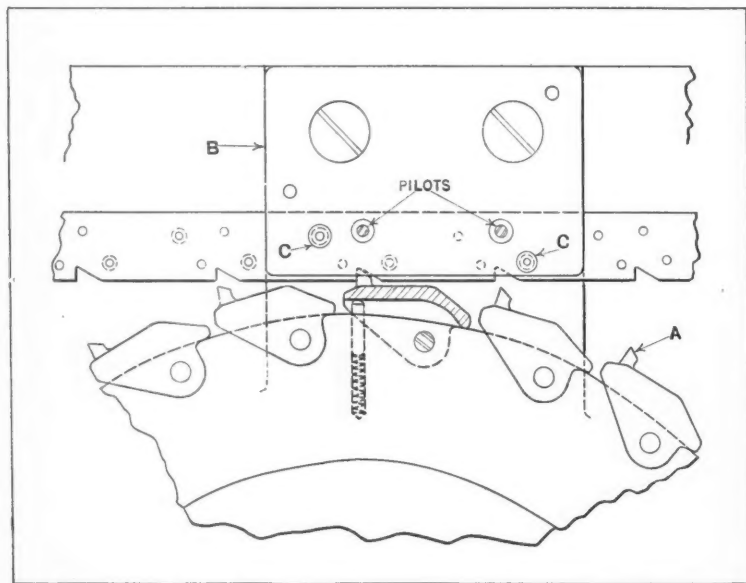


Fig. 3. Tapping Machine Dial Provided with Pawls for Automatically Feeding the Strip

mention that the lay-out of the die is such as to permit two parts to be blanked simultaneously in a subsequent operation. The notches in the side of the strip serve as locating points in all the succeeding operations.

Notches Form Part of Indexing Arrangement in Tapping Machine

After the necessary number of strips have been pierced and notched, they are removed to an automatic dial tapping machine of standard make, where the required holes are tapped, as indicated at B in Fig. 2. This machine has a multiple tapping head carrying two tapping spindles. In this case, instead of employing the automatic indexing dial as a work-holder, its outer edge is provided with ratchet pawls—one for each regular dial station—as may be seen at A in Fig. 3.

The strip is passed into the stationary guide *B* secured to the machine, and as the dial is indexed, one of the pawls engages the first notch and carries the strip toward the left until the indexing movement ceases. At this time, two of the pierced holes in the strip are directly beneath the guide bushings *C* in the guide *B*. The two taps now descend and tap the holes, after which the taps ascend and allow the pawls to carry the strip along to its next position when the dial is indexed.

As the vertical movement of the tapping spindles is automatic, the operator need only start each

strip into the guide, after which the strip is completely tapped without further handling.

Swaging, Blanking, and Forming Two Parts Simultaneously

The final operation on the terminal combines the swaging of the contact end, blanking, and forming. All these operations are performed in the die shown in Fig. 4. Here, again, the notches serve to locate the strip for each successive step.

The strip is fed into the die by hand until it comes against the automatic stop *A*. This stop is operated

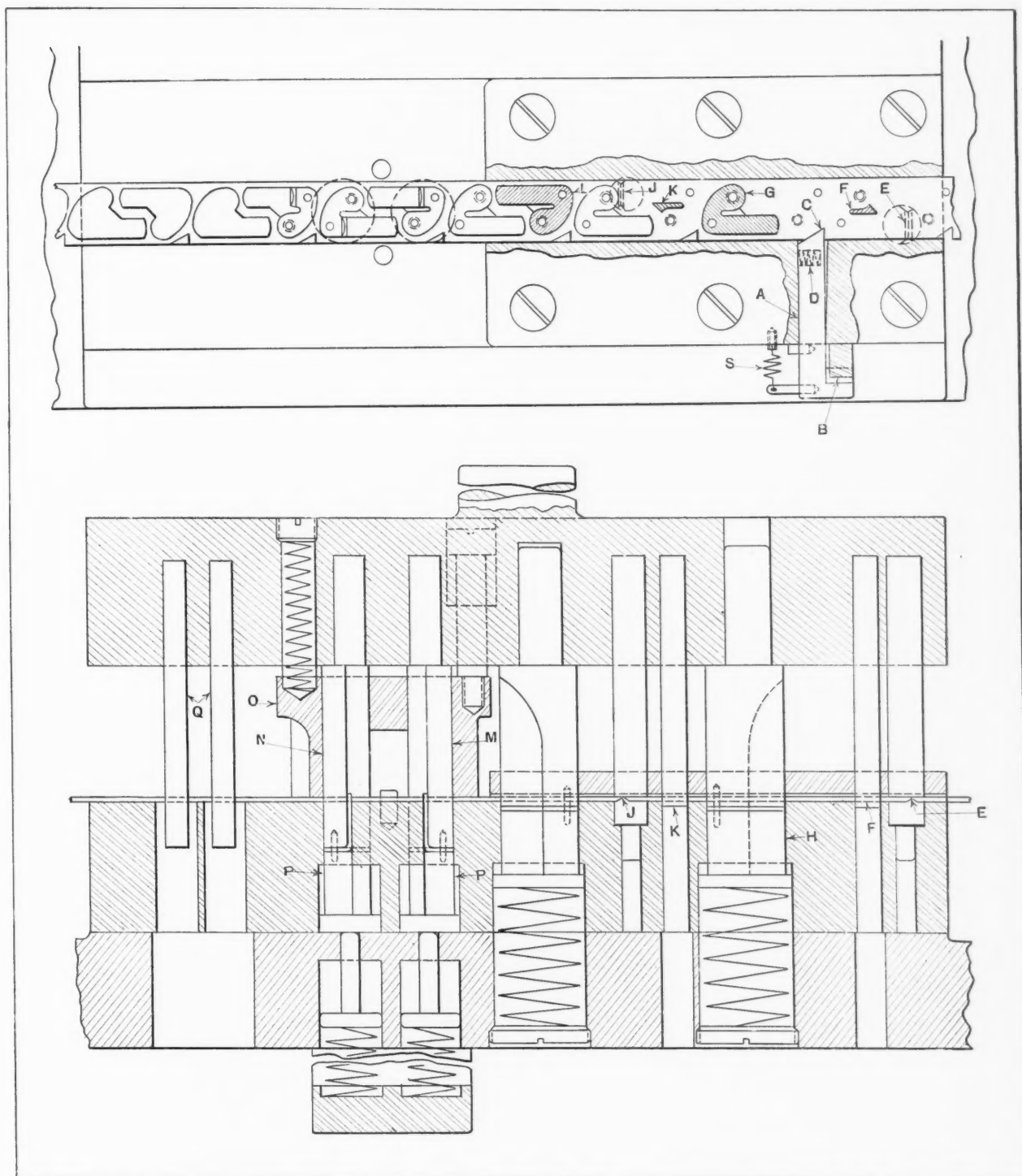


Fig. 4. Progressive Die for Blanking and Forming. Here, Also, the Notches Serve to Locate the Strip for Each Step

by the cam-finger *B*, secured in the punch-holder, which pulls the stop away from the strip as the ram of the press reaches the bottom of its stroke. When the ram ascends, the stop is released and allowed to move toward the strip. In doing this, however, it is forced toward the right by the spring *D*, so that the end *C* does not again pass in front of the strip but rests against its edge.

After the ram has ascended far enough so that the punches clear the strip, the operator pushes the strip toward the left until the end of the stop, through the action of the spring *S*, drops into the first notch. Each successive feeding movement of the strip is obtained in this manner.

In the first step, the notched side of the strip is swaged at *E* and pierced at *F*. Piercing the narrow slot *F* at this time enables a blanking punch of greater strength to be used and facilitates the forming of the part in the succeeding steps.

The part is blanked at *G* in the next step and then pushed back into the strip by means of the spring pad *H*, after which it is carried along to the next step. No operation is performed on it here, but the strip is swaged at *J* and pierced at *K* for

the parts to be made from the opposite side of the strip.

Again, in the next step no operation is performed on the part blanked at *G*. However, the part pierced and swaged in the preceding step is blanked at *L* and also pushed back into the strip. Now both parts are completely blanked, and they are carried along to the next step, where the contact ends are formed by the punches *M* and *N*. During this operation, both parts are held tightly between the ends of the spring pads *O* and *P*. After being formed, the completed parts are once more forced back into the strip to be carried along to the next step, where they are pushed through the strip by the rods *Q* and drop down into a container under the press.

The unusual number of steps in this die were required to allow a sufficient amount of metal between the die holes. Pilot-pins in the ends of several of the punches serve to align the strip during its passage through the die. It is obvious that the method here described can be applied advantageously, with some modifications, to a great number of parts manufactured in power presses, particularly when the parts are awkward to handle.

Self-Centering Ball-Contact Chuck

By WILLIAM C. BETZ, Master Mechanic
Fafnir Bearing Co., New Britain, Conn.

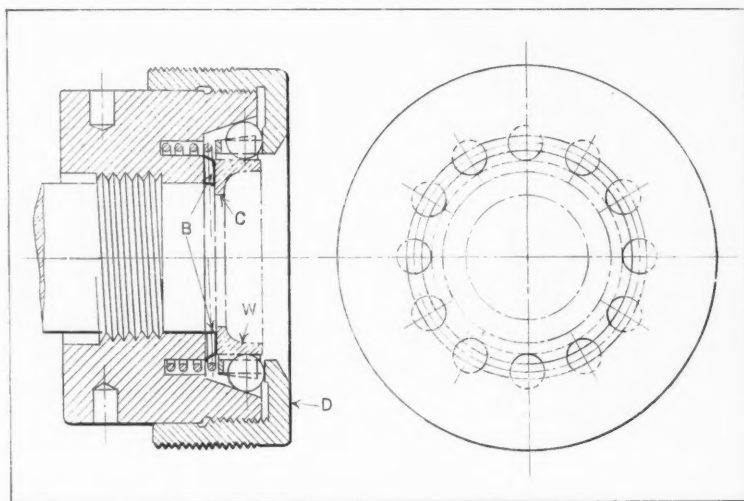
A chuck constructed as shown in the accompanying illustration will be found very useful for accurately centering and holding various kinds of work. The design is particularly well suited for use in grinding the bore *C* of pieces, such as the one shown at *W*, which have been hardened and ground on the outside. This type of chuck can also be used for holding soft work while taking light machining cuts.

The body of the chuck should be hardened and the angular or tapered surface on which the balls make contact should be ground. The inner face of the cap *D* should be ground true with the center line of the threads to insure having the balls roll concentrically when the cap *D* of the chuck is tightened.

Changing the pitch of the threads on the cap affects the clamping action

of the chuck. When a very fine thread is used, only a slight tightening pressure is required to hold the work, while with a coarse thread, the chuck does not tend to grip so tightly. A coarse thread is better for light weight work, as it makes it easier to determine when the proper clamping pressure is exerted. Thus, with a coarse thread, there is less danger of distorting the work.

On tightening the cap *D*, the work is carried back against the shoulder *B*, which insures holding the face of the work at right angles to the axial center line. The spring in back of the ball retainer holds the balls against the inner face of the cap so that the work can be easily inserted or removed. The steel balls must be of uniform size in order to insure accurate centering and an even clamping pressure on all sides of the work.



Self-centering Chuck with Ball Contacts

Making Expansion Fits with Liquid Air

THE term "shrink fit" is well known, but how many mechanical men have heard about "expansion fits" before? The expansion fit is something entirely new in the mechanical field. This term describes accurately the method of assembling a pin, shaft, or bushing in a hole of slightly smaller diameter by cooling the inner member with liquid air so that it will contract sufficiently to enter the hole. While this process is not recommended where ordinary shrink fits can be made by heating the outer member in the usual manner, there are numerous cases where fits can be made more advantageously and economically with liquid air than with heat. In fact, liquid air can be used in some cases where heat could not be employed. Also, there are instances in which both liquid air and heat are used to advantage in making fits.

When the outer member is very large and heavy, as compared with the inner member, or when the heating of the parts causes cracking or warping, it may be good practice to use liquid air. Fits can

By E. V. DAVID and W. S. FARR
Applied Engineering Department
Air Reduction Sales Co., New York

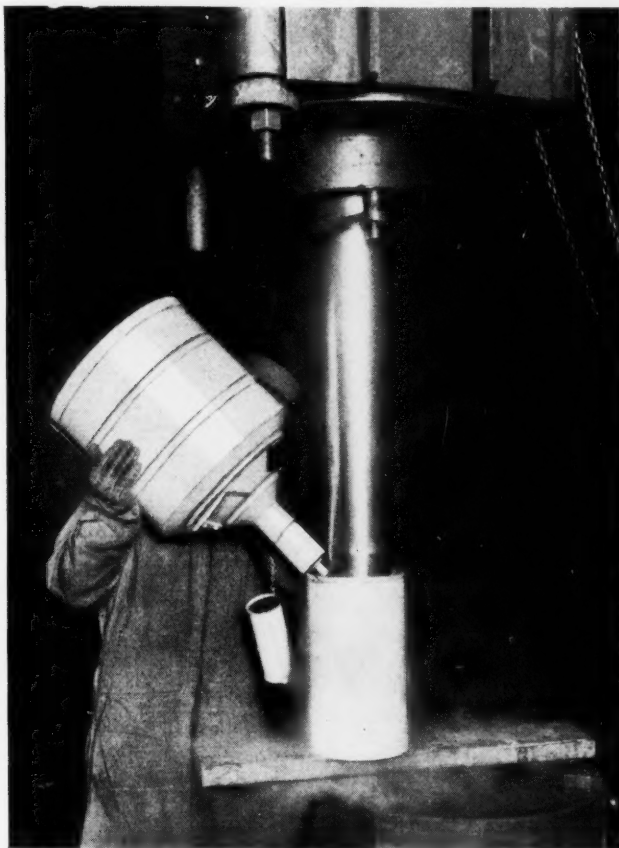
also be made with liquid air where heat would injure rubber parts, insulation, or other materials attached to one of the members. Again,

liquid air may be used where a suitable furnace is not available for heating the work. Thus it is obvious that this comparatively new method of making fits offers many possibilities.

Liquid air with an analysis varying from 40 per cent liquid oxygen and 60 per cent liquid nitrogen to 60 per cent liquid oxygen and 40 per cent liquid nitrogen is suitable for making expansion fits. The boiling temperature of such a liquid is somewhere between that of liquid oxygen and liquid nitrogen, depending on its composition, and for estimating expansion fit allowances, may be taken as -190 degrees C., which is equivalent to -310 degrees F.

In evaporating, liquid air absorbs heat but remains at the boiling temperature as long as any liquid is left. The heat absorbed does not raise the temperature of the liquid, but is utilized entirely in evaporating it. For expansion fit practice, it

Pouring Liquid Air into a Container Surrounding a Tapered Piston-rod End. The Haze of Steam around the Container is Caused by the Cold Liquid Air Condensing the Moisture in the Atmosphere



An Example of an Expansion Fit—Piston-rod Expanded into its Piston by the Use of Liquid Air. The Lines and Dimensions Show the Approximate Diameter of the Rod and the Length of the Taper

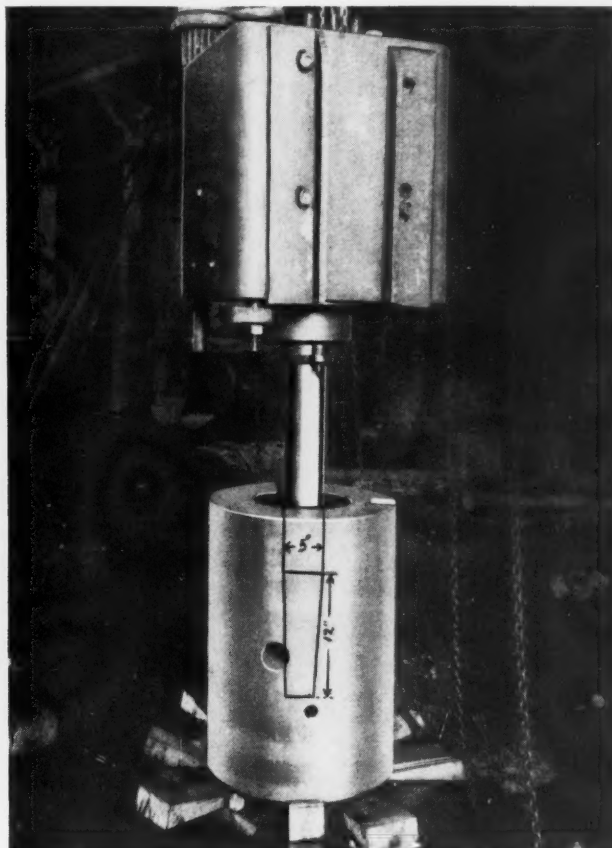


Table 1. Data for Determining Approximate Amount of Liquid Air Evaporated in Cooling Metals

Kind of Metal	Weight of Metal per Cubic Inch, Pounds	Heat Given Off per Pound of Metal Cooled, B.T.U.	Weight of Metal Cooled per Liter of Liquid Air Evaporated, Pounds	Amount of Liquid Air Evaporated per Pound of Metal Fully Cooled, Liters
Aluminum...	0.098	71.4	2.80	0.357
Brass.....	0.310	33.1	6.04	0.166
Bronze.....	0.323	34.2	5.85	0.171
Cast Iron...	0.260	39.5	5.06	0.198
Copper.....	0.322	29.7	6.73	0.148
Monel Metal.	0.318	34.2	5.85	0.171
Nickel.....	0.317	34.6	5.78	0.173
Steel.....	0.285	34.6	5.78	0.173

may be assumed that 200 B.T.U. are required to evaporate one liter of liquid air, or that 90 B.T.U. are required to evaporate one pound of liquid air. Thus liquid air has a capacity for withdrawing 200 B.T.U. from parts immersed in it, per liter of liquid evaporated.

A metal part at 70 degrees F. is relatively very hot, compared to liquid air at the boiling temperature of -310 degrees F. When a part is immersed, the liquid air boils violently and continues to boil until the part has been cooled to the temperature of the liquid. This may require several minutes with heavy parts. The quantity of heat withdrawn from the submerged part is exactly equal to that absorbed by the liquid air, which, in turn, indicates the amount of liquid air evaporated by the part.

As each 200 B.T.U. given off by the part will evaporate one liter of liquid air, the shape of the part has no effect on the amount of liquid required; however, the shape does affect the time element, a flat piece with a large surface area requiring much less time to cool than a spherical part of the same weight but of smaller surface area. When only a portion of a part is submerged, as the end of a shaft, for example, an allowance must be made for heat conduction, the amount of liquid evaporated being greater than if the portion submerged were a separate piece. The amount of additional liquid required can best be determined by trial.

Containers for Transporting Liquid Air

As liquid air maintains itself constantly at the boiling point, it must be transported in containers

Table 2. Approximate Linear Contraction per Inch of Length or Diameter for Different Metals when Cooled from $+70$ Degrees F. to -310 Degrees F. in Liquid Air

Kind of Metal	Contraction, Inches
Aluminum.....	0.0038
Brass.....	0.0031
Bronze.....	0.0038
Cast Iron.....	0.0018
Copper.....	0.0029
Monel Metal.....	0.0025
Nickel.....	0.0021
Steel.....	0.0020

that are open to the atmosphere, so that the vapors may escape. As nitrogen is more volatile than oxygen, the liquid, in evaporating, gradually becomes richer in oxygen, so that the final residue may be fairly pure oxygen. The shipping containers employed for liquid air are of the metal, long-necked, vacuum type. A container of 25 liters capacity, when standing, has an evaporation loss of 4 to 8 per cent per twenty-four hours, and the losses are increased somewhat during transportation due to the motion of the liquid.

Estimating Amount of Liquid Air Required

In estimating the amount of liquid air required for a job, a sufficient amount must be allowed for evaporation and other losses during transportation and handling. When the distance or shipping time between the oxygen plant and the user is excessive, the losses of liquid air may be so great as to render its use uneconomical.

For trial purposes, the parts to be fitted should be weighed and the amount of liquid air required to cool them calculated from Table 1, adding, say, 50 per cent to allow for working container losses, and 6 per cent for each twenty-four hour period the shipping container is in transit.

The vapor from liquid air as it evaporates is at a very low temperature, and its refrigerating capacity may be used to advantage for pre-cooling parts so that they will evaporate less liquid air when immersed. The vapor may be piped to a separate pre-cooler or the parts may be suspended in a wire mesh or perforated metal basket in the upper part of the working container before they are placed in the liquid.

Allowances for Expansion Fits

The approximate contraction or decrease in linear dimensions of parts made of various metals, per inch of length or diameter, when fully cooled in liquid air from a room temperature of 70 degrees F., are given in Table 2. The resulting stresses in parts assembled by an expansion fit depend upon the fit allowance. If the allowance is too great, the elastic limit of the material in one or both parts will be exceeded and a permanent set will occur. In extreme cases, the ultimate strength of the metal may be exceeded, causing a rupture. The intensity of the grip and the resistance to slippage of expansion fits increase with the thickness of the parts.

The contraction that takes place when using liquid air is ordinarily less than the expansion produced by heat for shrink fits. Therefore, smaller fit allowances are required for fits made with liquid air. The inner part, when fully cooled in liquid air, should slip easily into the hole in the outer part without forcing or driving. It should be at least a sliding fit in the outer part.

The sliding fit allowances recommended for trial fits are given in Table 3. The trial fit is obtained by machining the inner part at room temperature to a diameter larger than the hole in the outer part, or over size, by the amount that the inner part will

contract in liquid air as determined from Table 2, less the sliding fit allowance taken from Table 3.

Combination Expansion and Contraction Fits

When the diameters are too small for satisfactory expansion fits, or when an unusually powerful grip is specified, the fit may be made by cooling the inner part in liquid air and heating the outer part. In such cases the outer part is usually heated in boiling water (212 degrees F.). The outer part is thus expanded and the inner part contracted so that they can be assembled.

The approximate linear expansion per inch of length or diameter for parts of different metals, on being heated from 70 to 212 degrees F., is given in Table 4. For a combination fit, the inner part should be machined at room temperature to the same diameter as for an expansion fit, except that an allowance should be made for the expansion of the hole in the outer part.

Breaking Fits with Liquid Air

In some cases, when the inner parts are hollow, they can be immersed in liquid air or filled with it and contracted before the cooling action affects the outer parts. When the operation is performed rapidly, fits may be broken in this manner without the use of force.

Examples Illustrating Application of Liquid Air to Expansion Fits

Example 1—It is desired to expand 500 bronze valve-seats weighing 0.25 pound each into aluminum bronze cylinder heads of airplane engines. How many liters of liquid air would be required for the actual cooling of the parts?

Solution—The total weight of the parts equals $500 \times 0.25 = 125$ pounds. From the right-hand column of Table 1 we find that 0.171 liter of liquid air is required to cool one pound of bronze. Therefore, the amount of liquid air required for 125 pounds is $0.171 \times 125 = 21.4$ liters.

Example 2—A brass bushing 2 1/2 inches in diameter at 70 degrees F. is immersed in liquid air. What will its diameter be after cooling?

Solution—The contraction per inch of brass is found in the right-hand column of Table 2 to be 0.0031 inch. Then the total contraction for the bushing will be $2.5 \times 0.0031 = 0.0077$ inch. Hence the diameter after cooling will be $2.5 - 0.0077 = 2.4923$ inches.

Example 3—A brass bushing is to be expanded in a 2-inch hole in a casting. To what diameter should the bushing be machined?

Solution—The contraction per inch of diameter, taken from Table 2, is 0.0031 inch. The total contraction for the 2-inch bushing is, therefore, 0.0062 inch. Subtracting the allowance for a sliding fit, as taken from Table 3, we have $0.0062 - 0.002 = 0.0042$ inch, which is the amount the bushing should be over size. This amount, plus the diameter of the hole, gives 2.0042 inches, the diameter to which the bushing should be machined.

Table 3. Allowances and Tolerances for Sliding Fits

Diameter of Fit, Inches	Allowance for Close Fit, Inches	Allowance for Moderate Fit, Inches
1/2	0.00025	0.0005
1	0.0005	0.001
2	0.001	0.002
3 1/2	0.002	0.0035
6	0.003	0.005

Example 4—A hardened steel bushing is to be fitted into a 3 1/2-inch bore in a thick cast-iron pedestal by cooling the bushing in liquid air and heating the pedestal to a temperature of 212 degrees F. What size should the bushing be made?

Solution—From Table 4, we find that the expansion of the hole when the casting is raised to a temperature of 212 degrees F. is 0.0008 inch per inch of diameter, or 0.0028 inch for the 3 1/2-inch hole. The diameter of the hole at 212 degrees F. is, therefore, $3.5000 + 0.0028 = 3.5028$ inches. The contraction of the bushing per inch of diameter, as given in Table 2, equals 0.002 inch. The total contraction of the bushing, therefore, equals $3.5028 \times 0.002 = 0.007$ inch. Subtracting the allowance for the sliding fit, as given in Table 3, we have $0.007 - 0.003$ inch = 0.004 inch, which is the amount the bushing should be over size in the expanded hole. The diameter to which the bushing should be machined, therefore, equals the diameter of the hole at 212 degrees F. + 0.004 inch = 3.5068 inches.

Precautions and Instructions for Handling Liquid Air

The process of making expansion fits with liquid air, while essentially a simple one, requires the observance of certain rules to insure obtaining the best results.

1. Remove all grease, oil, etc., from parts before placing them in liquid air.
2. Thoroughly clean out working containers at regular intervals.
3. For insulation of working containers, use only materials of mineral origin, such as mineral or slag wool, asbestos, infusorial earth, etc.
4. Keep combustible materials away from the working area.

Table 4. Approximate Linear Expansion per Inch of Length or Diameter for Different Metals when Heated from 70 Degrees F. to 212 Degrees F.

Kind of Metal	Expansion, Inches
Aluminum.....	0.0018
Brass.....	0.0015
Bronze.....	0.0014
Cast Iron.....	0.0008
Copper.....	0.0012
Monel Metal.....	0.0011
Nickel.....	0.0010
Steel.....	0.0008

5. Open flames, cigarettes, etc., must be kept away from the vicinity of liquid air.

6. Replenish liquid air in working container now and then to maintain a fairly uniform level.

7. Do not allow liquid air to come in contact with the skin. Avoid handling cold parts with bare hands.

8. Parts should remain in liquid long enough to cool thoroughly, ordinarily for four or five minutes. Liquid will be observed to boil violently at first, then with gradually diminishing vigor, and finally, just before action ceases, it boils again violently for a few seconds. Wait for this signal.

9. Avoid filling working containers too full and immersing excessive quantities of parts at a time. Otherwise, boiling over and splashing will cause waste of liquid air.

10. Insert parts immediately upon removal from liquid. Delay will permit them to become frosted over. If they do, re-cool them before inserting.

* * *

Tool for Rough- and Finish-Turning Crankcase Neck

By CHARLES C. TOMNEY, Chief Tool Designer
Brunswick-Kroeschell Co., New Brunswick, N. J.

The combination rough-turning and finish-turning tool shown in Fig. 1 is used on a drilling machine, as shown in Fig. 2, for turning the necks or

flanges of crankcases like the one shown at *W*. The neck *Y* of the crankcase is turned to match the flange of its cylinder, and is held to size within plus or minus 1/64 inch. These crankcases are produced in small lots, and the tool illustrated was made primarily to avoid handling the job on the boring mills, which had an oversupply of work.

The operation shown in Fig. 2 is the last to be performed on the crankcase, with the exception of drilling and tapping. The preceding operations consist of boring and facing for the crankcase cover; planing or grinding the feet and the top; and boring the hole *A*, Fig. 1, which serves as a guide for the pilot *B*.

Referring to Fig. 1, the body *C* of the tool is a steel forging with a slot *D* milled across the end to receive the shanks of the tool-holders *E* and *F*. The roughing tool-holder *E* and the finishing tool-holder *F* can be adjusted independently of each other, slots *J* being provided in each holder for this purpose. Cap-screws *G* with washers *H* are used to clamp the tool-holders in place.

The pilot *B* is of casehardened steel, and is centralized with the body of the tool by the counterbore at *K*, which fits over a corresponding projection on the body. Two cap-screws *L* hold the pilot in place. The roughing cutter *M* is set about 1/4 inch lower than the finishing cutter *N*. Clearance holes *P* for a socket wrench are drilled in the pilot, so that the cap-screws *G* which clamp the tool-holders in position can be adjusted without removing the pilot. The tool is driven by a flat key which fits into a slot milled in the shank *R*.

* * *

Among the suggestions made by the Carboloy Co. for the grinding of carboloy tools are the following: That lighter feeds and softer wheels be used for the harder grades; and that wheels be dressed often to keep them from glazing and heating the work.

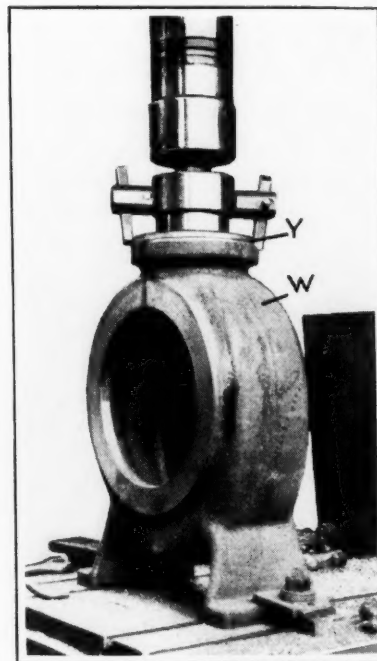


Fig. 2. Set-up for Rough- and Finish-turning Crankcase Neck

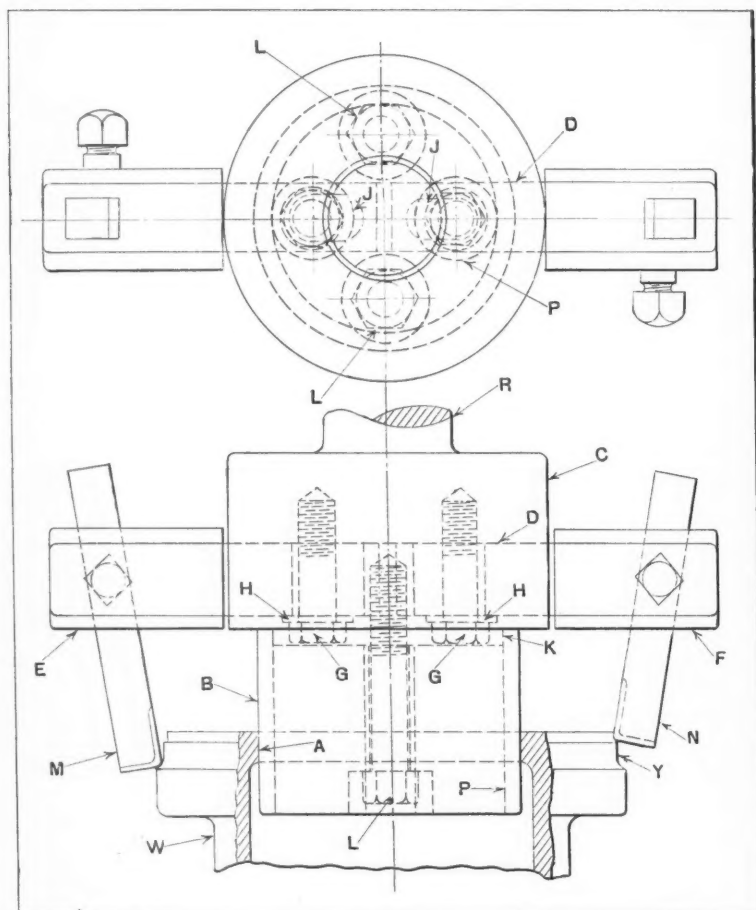


Fig. 1. Tool for Rough- and Finish-turning Crankcase Neck

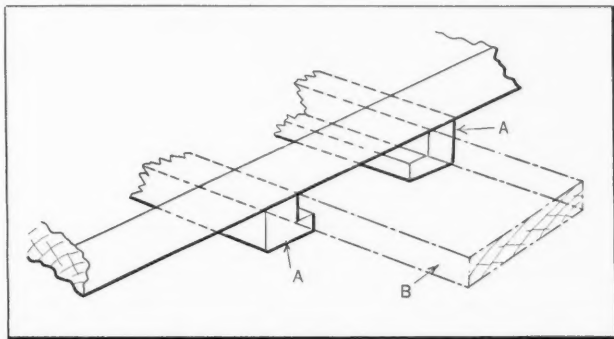
Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Extension for Drafting-Room Table

Considering the convenience of the sliding leaf on office desks, it seems strange that similar leaves are not used on drafting-room tables. Perhaps the most common method of mounting drawing-boards is to place them on angular supports which rest on the top of a table or bench. When this arrangement is employed, a sliding leaf can be easily secured to the under side of the table by means of two L-section strips of wood, as shown at A in the illustration. These strips support the leaf B, and should be made heavy enough to permit the leaf to support the weight of anyone who may lean against it.

The leaf should be made as long as possible to allow ample support when extended. It is well to



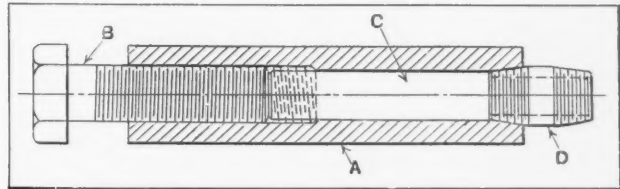
Method of Applying Sliding Leaf to Drafting Table

provide a stop which will limit its outward and inward travel. Besides holding reference books, the leaf can be used to support drawings that are too large to be held on the table alone. W. S. B.

Holder for Threading Short Pipe Nipples

Machinists and pipe fitters are often required to make a short pipe nipple of a special length or a close nipple with a special size thread for an over-size fitting. It is difficult to cut threads on work of this kind by the use of an ordinary pipe thread die without injuring the thread on one end while cutting the thread on the other end; in addition, some means of holding the nipple firmly is necessary. The illustration shows a holder for work of this kind that will not stretch the thread out of shape.

The steel body A is turned to an easy fit in the guide bushing of a die one or two sizes larger than the die to be used in cutting the thread on the pipe nipple. This body should be long enough to permit it to be held conveniently in the vise and to allow



Holder Used in Threading Pipe Nipples

the die stock to run on far enough to cut the thread on a close nipple. The right-hand end of body A is drilled about half way through with a pipe tap drill and tapped out to give an easy fit for the threaded end of the nipple. The hole is then drilled the rest of the way through and tapped to receive the screw B which has a left-hand thread. Plug C is made of steel; it is an easy fit in body A and acts as a stop for the nipple D.

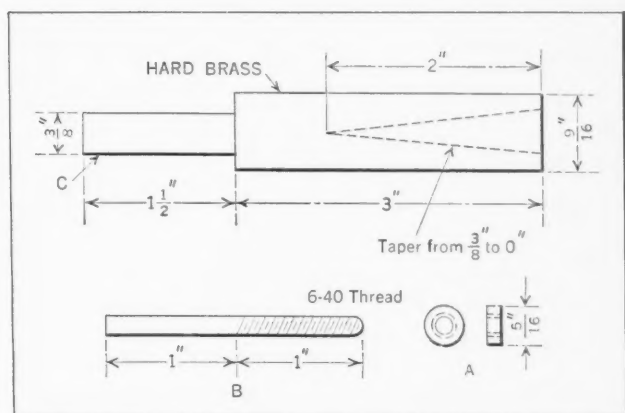
To use the holder, simply run screw B out a few turns and screw the nipple D in place lightly, without using a wrench. Next turn screw B in to bring plug C firmly against the end of nipple D. Screw B, having a left-hand thread, has a tendency to tighten under the strain of threading the nipple. After the nipple is threaded, it can be easily removed from the holder by loosening screw B.

Claremont, N. H.

F. E. CLARKE

High-Speed Driver for Round Nuts

The simple tool shown in the upper view of the accompanying illustration is credited with a considerable saving in the cost of assembling round nuts A on threaded pieces B. It may be adapted for many uses, and can be made in different sizes. The shank C is inserted in the chuck of a high-speed bench drill. The round nut A is started on the end of piece B, which is pushed up into the



Tool for Assembling Round Nut on Threaded Stud

taper opening in the tool so that the driver will catch the nut and spin it quickly down into position. The taper hole in the driver is produced by a taper drill.

Boston, Mass.

CHARLES R. WHITEHOUSE

Method of Identifying Steel

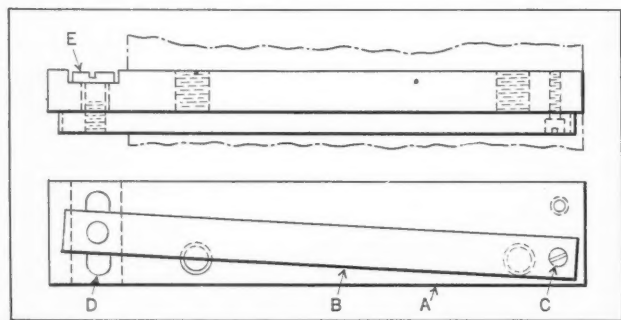
So many kinds of steel are used in the tool-room today that, in spite of the various precautions taken, tools are occasionally made from the wrong steel. Usually the error is not discovered until the piece is hardened. Such mistakes are costly.

However, this condition can be eliminated if the following plan is carried out: A small sample of each steel with its identification stamped on it is set aside for reference. Paint should not be used for marking the identifications, because it is easily blurred or rubbed off.

Different steels show different sparks when ground on an emery wheel. Hence, the identity of a piece of doubtful steel will be revealed by simply comparing its sparks with those of the samples.

Ansonia, Conn.

F. W. SHRIER



Work can be Supported at Various Angles in a Milling Vise with this Simple Adjustable Jaw

Milling-Vise Jaw with Angular Adjustment

With the vise jaw shown in the illustration, work to be milled may be held at various angles. It consists of a rectangular plate *A*, secured in the usual manner to the solid jaw of the vise, and an angle bar *B*, pivoted on screw *C*, which serves as a support for the work being milled.

Bar *B* can be set at any angle within the limits of the elongated slot *D*, and by tightening the screw *E* in the slot, the bar is held rigidly with respect to the solid vise jaw. Should it be required to have bar *B* inclined in the opposite direction, the pivot screw *C* may be shifted to a tapped hole in the upper part of member *A*.

Springdale, Conn.

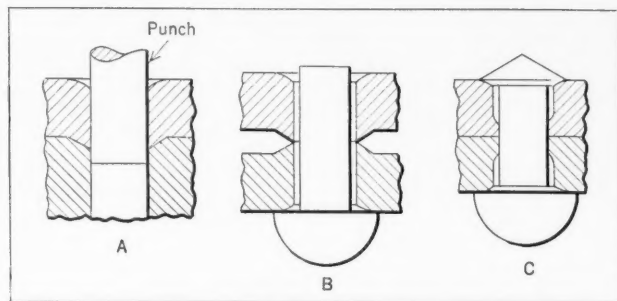
THOMAS M. GARRY

A Riveting Kink

In some classes of riveting, extra large clearance holes for the rivets are provided in the parts in order to facilitate the assembly. Thus the rivet does not fill the hole and the members are held together merely by the friction created by the pinch-

ing of the rivet heads. As a result, the parts often become loose.

In the accompanying illustration is shown a method of overcoming this difficulty. The hole in the die for piercing the holes in the parts is countersunk, as indicated at *A*, so that a projection or enlarged burr is formed around the pierced hole. When the parts are assembled, the projecting burrs



To Obtain a Tight Riveted Joint when the Holes Have a Great Deal of Clearance, a Lip is Formed as Shown at *A*. In Riveting, this Lip is Forced against the Rivet as at *C*

on the respective parts are placed together, as shown at *B*. As the joint is being made, the projections are forced against the rivet, thus forming a tight joint, as shown at *C*.

Rochester, N. Y.

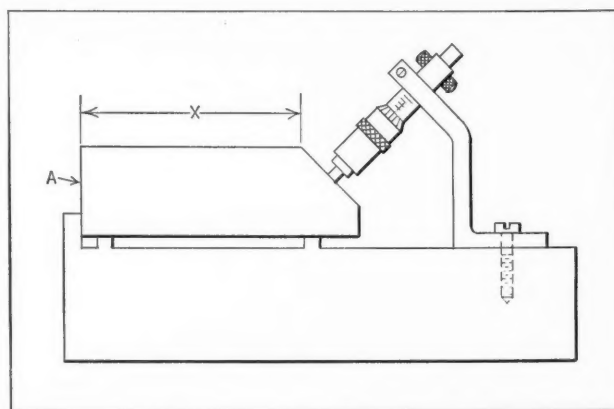
ERNEST C. ALLEN

Gage Equipped with Inside Micrometer for Checking Angular Surfaces

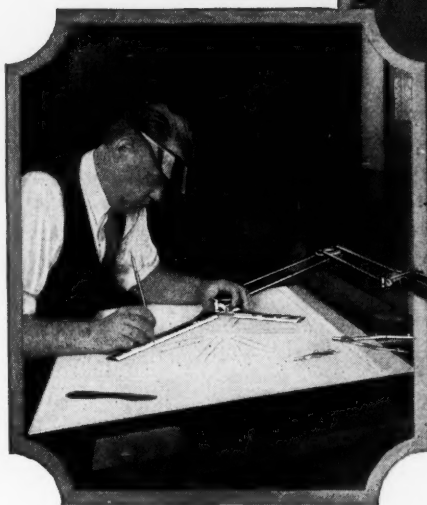
Angular surfaces are accurately gaged in one jobbing shop by means of an inside micrometer, which is mounted in a bracket secured to a metal base, as shown in the illustration. The work, indicated at *A*, is supported on this base and is prevented from moving longitudinally by a projection integral with the base. First a sample part is inserted in the gage and the correct reading *X* is noted on the micrometer. Then, all parts checked should correspond with this reading. A dial indicator can be used in place of the micrometer shown.

Philadelphia, Pa.

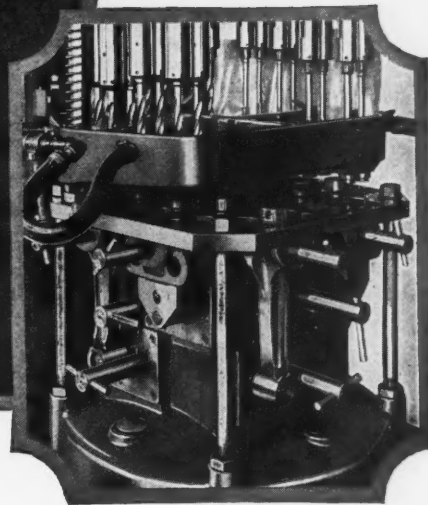
C. KUGLER



Using an Inside Micrometer for Checking Angular Surfaces



Design of Tools and Fixtures



Reversible Plate Jig for Drilling Matched Halves of Bearings

By F. SERVER

In Fig. 1 is shown a reversible plate type drill jig used for locating four dowel-holes in two halves of a split bearing. The half-bearings, one of which is shown by the heavy dot-and-dash lines at *W*, are put together in two matched units, which are afterward turned and faced while doweled together and clamped on an arbor, as shown in Fig. 2. This method of machining enables the two pieces to be taken apart for convenience in assembling on a machine.

The plate *A*, Fig. 1, has four posts *B* projecting from the sides, which serve as legs. This enables a half-bearing to be clamped on one side, as shown at *W*, and its matching half to be clamped in the position indicated at *Z*. The pieces are milled on the faces that are in contact with the plate *A* previous to drilling the dowel-holes. Of course, one-half of a lot of bearings is drilled by clamping them in the position *W* before reversing the jig for drilling the other half.

The four pins *D* which both project from both sides of the plate serve to lo-

cate the half-bearings from the corners of the rough castings. The drills are guided by the four bushings *N* located in plate *A*. The pins *Q* serve to hold the posts *B* in place. The reversible hinged cover *C* pivots about pin *J* and is clamped down on the work by the eyebolt *L* which pivots on pin *M*. Pin *M* is mounted in a block *P* which permits the eyebolt to swing through a complete half-circle. The pin *J* is mounted in a hinged block *F* which is free to swing through a half-circle about the pin *H*.

While drilling one group of the half-bearings, the hinged cover *C* is in the position shown. For the other group of bearings, the block *F*, as well as the eyebolt *L*, is swung around to the opposite side to clamp the work in the position shown at *Z*. This permits the two groups to be drilled from opposite

sides of the jig plate, so that they will be accurately matched. In order to avoid any mistake in assembling two matched half-bearings, the drill bushing *N* nearest the upper left-hand corner of the drill plate is located somewhat nearer the center of the bearing than are the other three bushings.

After the two half-bearings have been doweled together, they are clamped in a chuck and a hole is drilled and reamed through the center

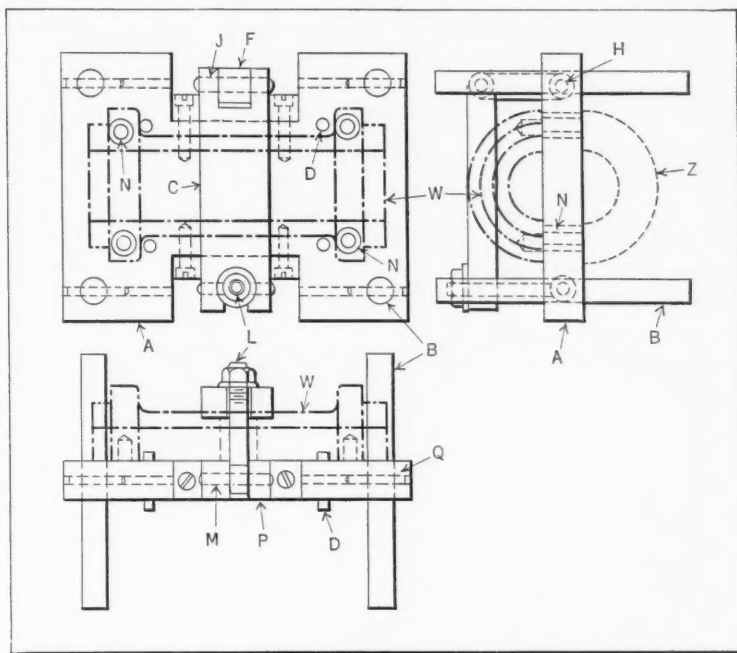


Fig. 1. Reversible Plate Type Jig Used in Drilling Dowel-holes in Matched Halves of Split Bearing

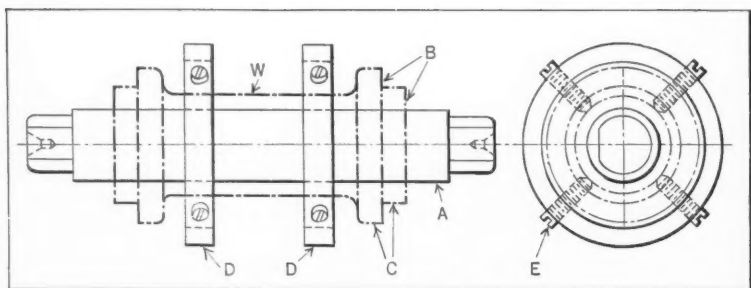


Fig. 2. Matched Halves of Bearing Mounted on Arbor for Turning and Facing Ends

to fit the arbor shown at A, Fig. 2. The matched half-bearings are then mounted on this arbor for turning and facing the surfaces B and C at each end. Two rings D, provided with four radially positioned set-screws E, clamp the bearings to the arbor A during the performance of the turning and facing operations. When the half-bearings are finished, they are numbered and kept together. When put in place on the machine, a ring gear is forced over each end of the bearing. The gears are doweled and secured to the bearing flanges by screws so that the assembly is fastened together securely.

Friction Wrench with Positive Reverse

By EDWARD HELLER, Cleveland, Ohio

The friction wrench shown in the accompanying illustration was devised for use in assembling framework made up of light pressed steel members which were bolted together by long tie-rods. The ordinary socket wrench proved unsatisfactory for this job, as the workman could not tighten the nuts uniformly and exhibited a tendency to exert too

much pressure on the wrench, which caused the steel members to be sprung out of shape. In some cases this springing of the steel member actually ruined the framework.

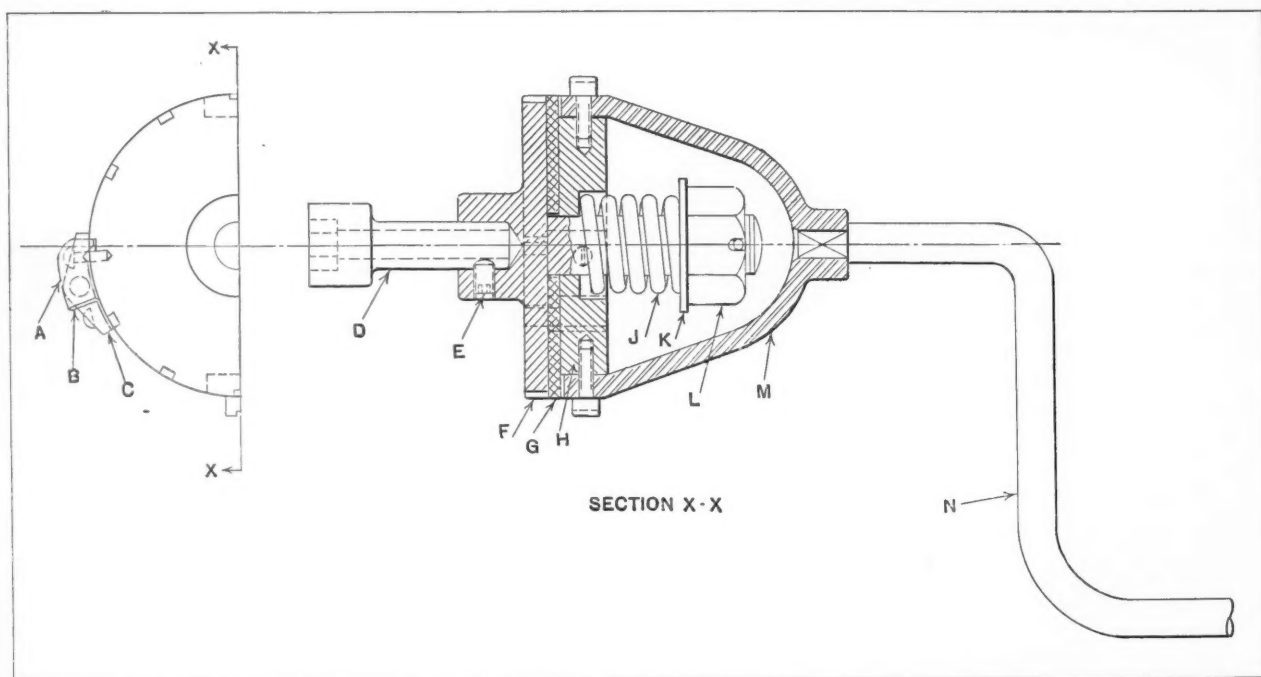
The commercial type electric friction wrenches were too fast in operation to permit the parts to be assembled properly, and as such wrenches could be operated in only one direction, it was necessary for the assembler to use an ordinary socket wrench for removing the nuts when making readjustments or correct-

ing mistakes. These difficulties, however, were overcome by using the wrench illustrated, which has two plates F and H with a piece of friction brake lining or fiber G between them. These three parts are held together by the nut L and washer K.

The friction driving pressure is derived from the heavy spring J. The fork M, to which the ordinary crank or brace N is riveted, is set in the sides of the plate H, where it is fastened securely by screws. The plate F has a hub for holding socket wrenches D of different sizes. The socket wrench is held in place by a set-screw E, which enters a deep spot in the shank.

To use the wrench, the nut L is first adjusted until the driving member slips at the correct tension required for setting the nuts, after which nut L is locked with a cotter-pin as shown. With the wrench set in this manner, all nuts will be tightened uniformly, regardless of who does the work.

The plate F has twelve notches on its periphery. A pawl A, pivoted on a bracket C, is located at one side of the upper plate H. A light flat spring B, fastened between members C and H, has a small projecting end which bears on a flat surface on



Friction Wrench with Positive Reverse, for Tightening Nuts Uniformly

pawl *A* and keeps the latter member pressed against plate *F*. After a nut is set tight, the lower part of the wrench ceases to rotate, causing the pawl *A* to produce an annoying clicking sound as it falls into the notches in plate *F*. This clicking noise indicates to the workman that the nut is properly tightened. If the workman should turn the crank in the opposite direction, pawl *A* would fall in a notch and carry the plate *F* along in the same direction, just as though the whole assembly constituted a solid wrench. This feature permits the workman to remove a nut at any time without changing wrenches.

Die for Producing 2400 Hook-Bolts per Hour

By H. E. HERMANN, Moline, Ill.

In Fig. 1 is shown a machine-steel hook-bolt made from 3/8-inch round bar stock, which is bent and cut off in a press die at the rate of 2400 pieces per hour. The die, which takes four bars at a time, is shown in Fig. 2. The four bars enter the holes in holder *A* and are located against the gage or stop *B*. The shear block *C* and the forming tool *D* travel downward together until the forming tool strikes the material and compresses the springs *E*, which serve to prevent the sheared pieces from moving out of position under the forming punch. The upper block, continuing its downward movement, strikes the forming tool and causes it to bend the four cut-off pieces simultaneously.

On the return stroke, the ledge *F* strips the work from the forming tool. The compression springs *G* return holder *A* to its original position. It will be

noted that a block *H* is provided to force holder *A* down during the shearing operation, so that the work moves downward with the shear block *C* and thus maintains a level or horizontal position. The small end of the hooked bolt is rounded slightly during the forming operation, as shown at *J*, Fig. 1. The die described may, of course, be modified or adapted for bending a variety of small parts.

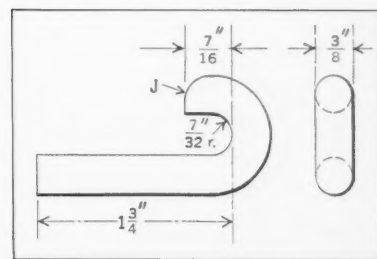


Fig. 1. Hook-bolt Formed and Cut off by Die Shown in Fig. 2

Threading-Tool Grinding Fixture

By FREDERICK J. NAAB, Philadelphia, Pa.

After having had considerable experience with threading-tool grinding fixtures, the writer originated the templet type of fixture shown in Fig. 1. The method of using a fixture of this type is shown diagrammatically in Fig. 2. The templet consists simply of a flat plate machined accurately to the required thread angle, and a block for holding the tool to be ground. These templets are made for different sizes of tools and with angles to suit any form of thread. The templet shown in Fig. 1 is used in grinding U. S. standard threads and sharp V-threads, while the templet shown in Fig. 2 has an included angle of 29 degrees and is used in grinding tools for cutting worm threads.

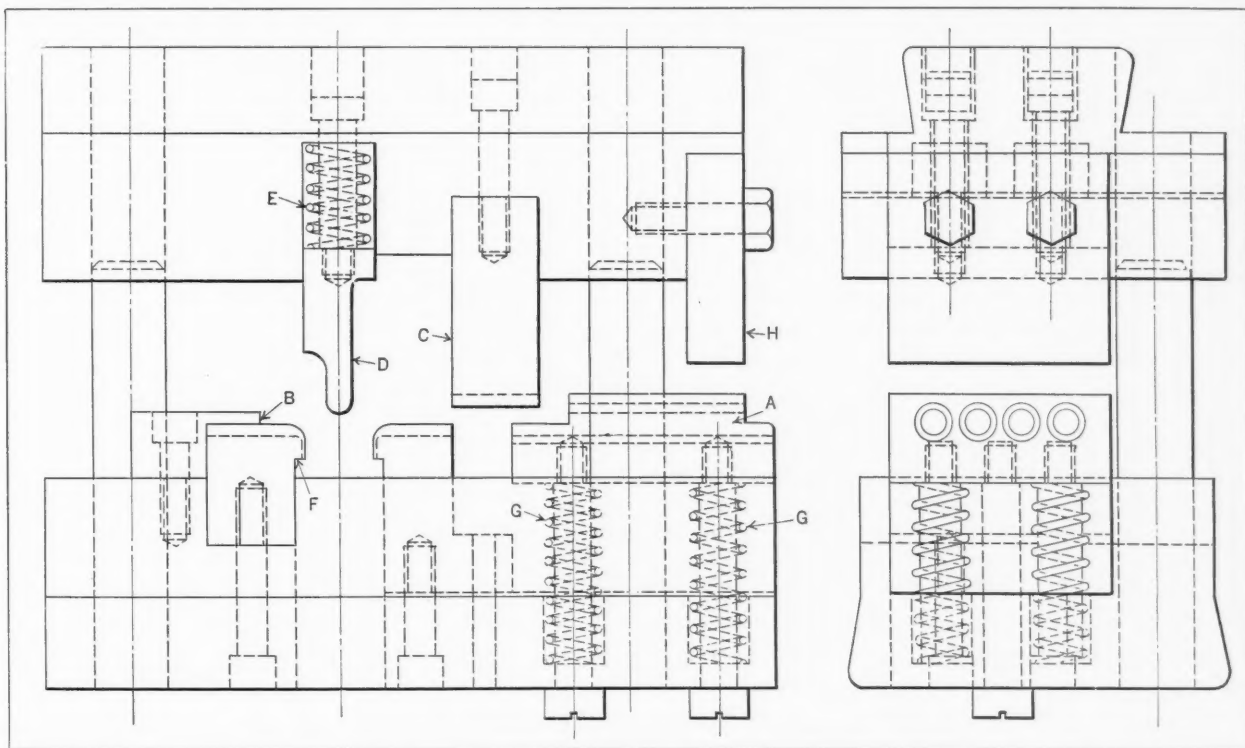


Fig. 2. Die which Cuts off and Forms 2400 Hook-bolts per Hour

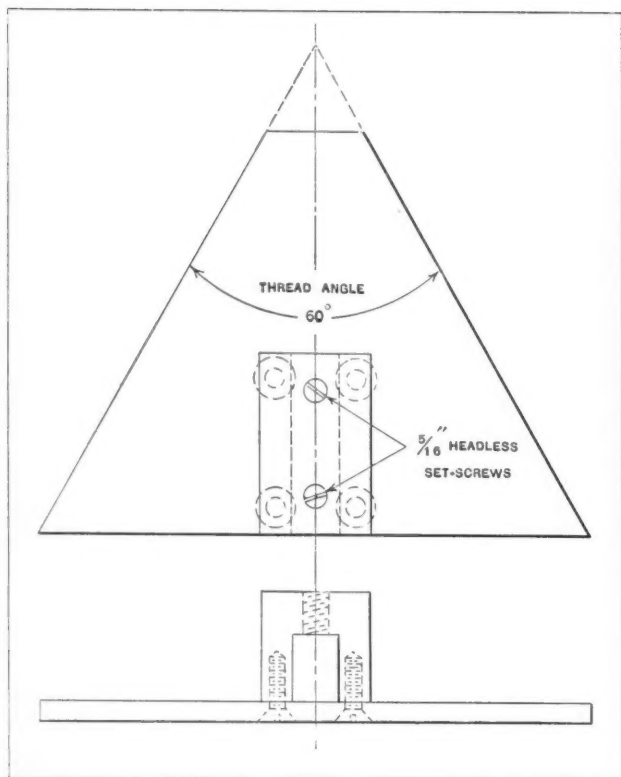


Fig. 1. Templet Used in Grinding Threading Tool Having an Included Angle of 60 Degrees

In using the templet, the rough-ground tool is first clamped in place with the top face in contact with the plate, as shown in Fig. 2, two set-screws being used to hold the tool securely in position. The templet is then clamped to the adjustable angle-plate, which is set to the clearance or helix angle at the root of the thread plus an allowance of about 2 degrees.

A small C-clamp or a parallel clamp is used to hold the templet in place on the angle-plate, care being taken to have the lower edge of the templet in contact with the grinding machine table. After one side of the tool has been ground, the position of the templet on the angle-plate is reversed and the other side is ground. The flat at the end of the tool is ground by having the parallel end of the templet in contact with the machine table and the angle-plate adjusted to the required clearance angle.

With this type of grinding fixture, the thread angle is fixed, and there is no adjusting of a movable member on a graduated scale to obtain the required thread angle. This feature eliminates a source of mistakes such as are frequently made with the adjustable type. Fixtures of the kind illustrated have been used in grinding all the tools of a very large concern for the last two years. The writer has also used this type of fixture in a government arsenal for grinding threading tools used in reliev-

ing worm-wheel cutting hobs. Fixtures of this kind are practically fool-proof and are used successfully by apprentice boys.

As an example of a specific application, we will assume that the fixture is to be used for grinding a tool for cutting a worm thread having an outside diameter of 2 inches. This worm is for use with a worm-gear of 4 diametral pitch. From a table in *MACHINERY'S HANDBOOK*, we find that the circular pitch or lead of a thread of this pitch is 0.7854 inch, and from formulas also found in the *HANDBOOK* that the helix angle at the root of the thread is approximately 15 degrees 12 minutes. Therefore, the adjustable angle-plate is set to an angle of about 17 degrees for grinding the leading side of the tool. After the leading side has been ground, the adjustable angle-plate is set to an angle of about 5 or 6 degrees and the following side is ground in a similar manner. The flat at the end of the tool is then ground by following the procedure previously described.

Tool for Cutting Dovetail Annular Grooves

By K. TAKAHASHI, Tokyo, Japan

It is the practice in one plant, before babbitting bearings, to cut dovetail grooves along the bores of the bearing shells in order to retain the babbitt. These annular grooves are cut in a horizontal boring machine by means of the recessing tool shown in the illustration.

The tool is secured by set-screws in the regular boring-bar *A* mounted in the machine spindle. The two cutters *B* and *C* are fastened in the angular slides *D* and *E*, and are fed into the bore by means of the sliding cams *F* and *G*. The slides are held in contact with the cams by coil springs. A sliding movement is imparted to the cams by the screw *H*, which is provided with right- and left-hand threads engaging corresponding threaded holes in the cams. This screw is actuated by one of the star-wheels

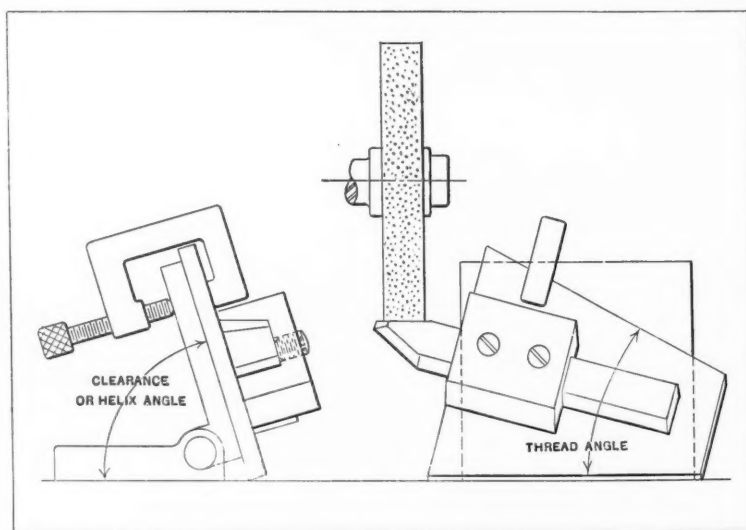
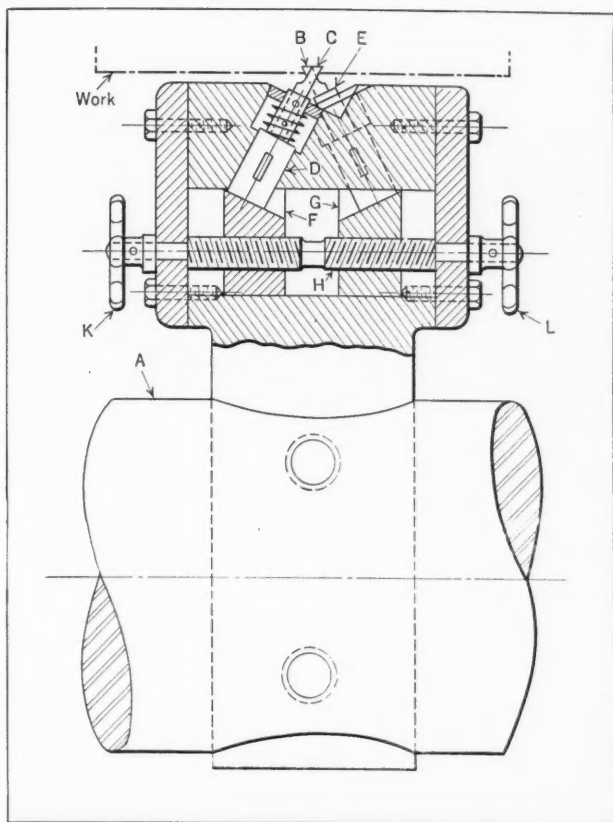


Fig. 2. Method of Using Templet and Angle-plate for Grinding Tool for Cutting Worm Threads



Recessing Tool for Cutting Dovetail Grooves

indicated at *K* and *L*, which are fastened to each end of the screw.

For each revolution of the boring-bar one of these star-wheels engages a stationary pin (not shown), which is secured to a bracket bolted to the machine table, and causes the screw to rotate, thus feeding the cutters into the bore of the bearing shell. Two star-wheels are provided so that in cases where both ends of a long bearing shell are to be grooved, a shorter stationary pin can be employed.

Jig for Drilling Bolt Circles Having Varying Center Distances

By W. E. GUNNERSON, Rockford, Ill.

Drilling two bolt circles, the center distances of which vary as much as 1/4 inch, is accomplished by means of the jig shown in the illustration. It consists of two similar bushing plates *A*, both provided with pilots *B* which are a slip fit in the counterbored holes in the work, shown by dot-and-dash lines.

Rectangular guide bars *C* fastened to the sides of the plate at the right are provided to maintain the alignment of the plates. The protruding ends of the guide bars engage grooves cut in the plate at the left. Thus the plates can be moved away from or toward each other, to compensate for the variation in the center

distances of the holes. It is obvious that as soon as the pilots drop into the counterbored holes, the jig is automatically locked in its drilling position.

Indexing Fixture for Splitting Crankpin Boxes

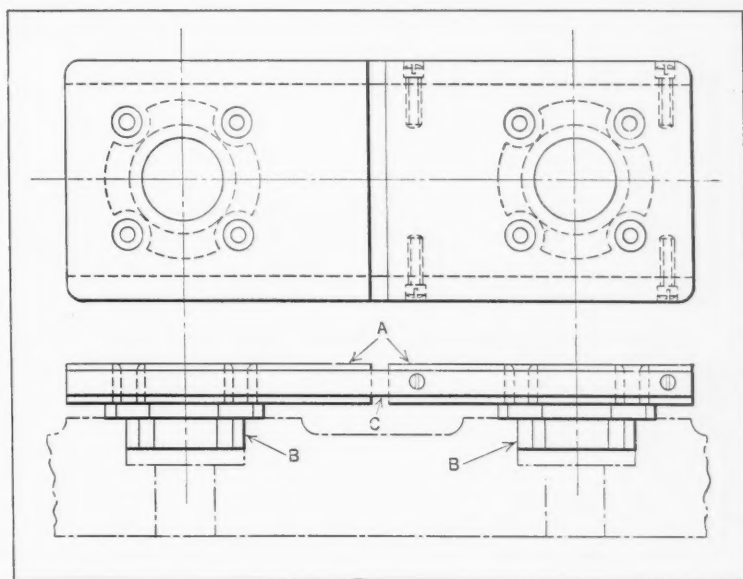
By CHARLES C. TOMNEY, Chief Tool Designer
Brunswick-Kroeschell Co., New Brunswick, N. J.

In the upper right-hand corner of the illustration (see page 200) is shown one of the crankpin boxes used on the 4 by 6 and 6 by 6 steam engines made by the Brunswick-Kroeschell Co. In the same illustration is shown the indexing fixture used for splitting these boxes at *A*. Although many other arrangements for splitting the boxes have been tried, the fixture illustrated has provided the only method that has given entire satisfaction.

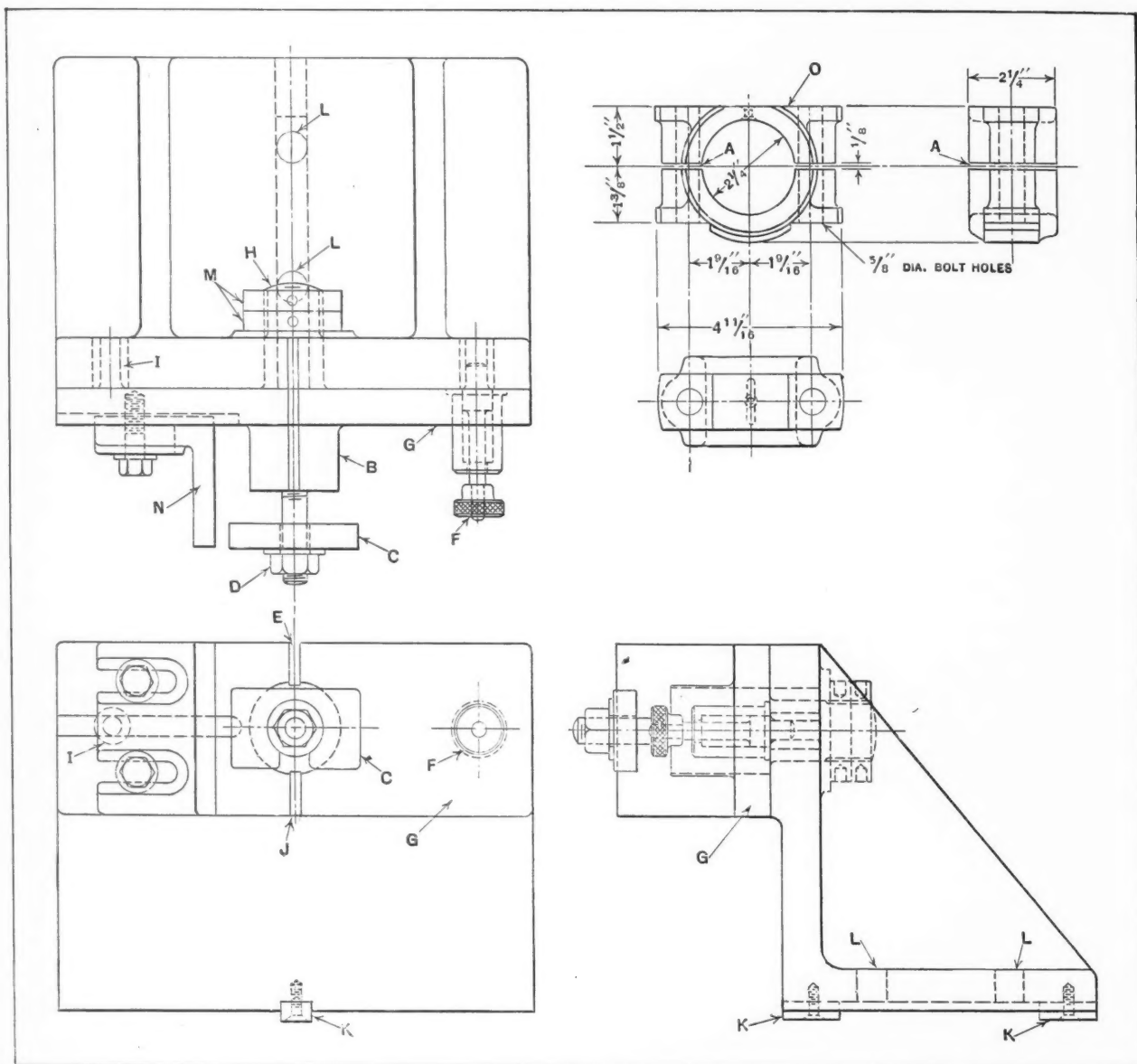
The boxes are all held to very close limits, even though they are fitted up in pairs. The unsplit box is clamped on the hub *B* by means of the clamp *C* and nut *D*. One side of the box is then split by the saw which passes through slot *E*. After one side is slotted, the index-pin *F* is withdrawn, the holder *G* swung around on its hub *H*, and the index-pin allowed to enter the bushing at *I*. This brings the slot at *J* into the position formerly occupied by slot *E* so that the other side of the box can be split.

The cast-iron body of the fixture has a groove milled in the base to receive the steel tongues *K* which fit the T-slots of the milling machine table. Holes are provided at *L* for the clamping bolts that secure the fixture to the machine table. The hub *H* is a turning fit in the reamed hole in the body of the fixture. The lock-nuts *M* are adjusted to permit the holder *G* to turn without play.

The hub *B* is machined integral with the work-holder *G* and concentric with the hub *H*. Hub *B* is made to fit the bore of the smallest crankpin box



Telescoping Jig for Drilling Two Bolt Circles which Vary in Center Distance



Indexing Type of Fixture Used in Splitting Crankpin Boxes

that is to be split. The slotted bushings used in splitting the larger sized boxes have pins driven into their ends that fit into slot *E* or *J* and thus serve to keep the bushings from turning on the hub *B*. Slot *E* is $1/32$ inch wider than the thickest saw used, and is milled through the work-holder and the body of the jig. This slot is also cut into the hub to a depth of about $1/16$ inch, so that the saw will have sufficient clearance. The angle-plate *N* is provided to locate the work so that the saw-cut will be parallel with the side *O* of the box.

* * *

From Printing Presses to Airplanes

It seems a far cry from printing presses to airplanes, and yet the manufacture of the first of these products in one instance has led to the manufacture of parts for the second. This interesting example of how a detail in a manufacturing process requiring extreme attention may be the cause of

developing an entirely new line of manufacture, foreign to a firm's regular product, was recently noted at the plant of the Meisel Press Mfg. Co., Boston, Mass.

This company manufactures printing presses—particularly presses of special design intended for the printing of tickets in strips, labels, wrappers, and many other varieties of printing jobs. In the manufacture of these printing presses, a large number of gears are required, and these gears must be of very high precision in order to synchronize all the different motions of the press. In order to obtain gears of the required quality, the company established its own gear-cutting department and soon after began to make gears for the trade. As a result, today, among the lines of manufacture of this company, are gear sets for airplane engines, and some of the leading manufacturers of these engines obtain their gears from the Meisel Press Mfg. Co. This, in turn, has led to the manufacture of other aircraft parts requiring great accuracy.

MACHINERY'S DATA SHEETS 213 and 214

PROPERTIES AND COMPOSITION OF SAND-CAST ALUMINUM ALLOYS*

Alloy Number	Ultimate Tensile Strength, Pounds per Square Inch	Yield Point, Pounds per Square Inch	Elongation, Per Cent in Two Inches	Brinell Hardness	Copper	Nickel	Manganese	Silicon	Zinc	Iron	Aluminum
12	18,000-23,000	10,000	1-3	65	8.0	....	....	....	....	....	92.0
43	17,000-22,000	7,000	3-7	40	....	....	....	5.0	....	....	95.0
45	17,000-21,000	9,000	1.5-3	50	....	....	....	10.0	....	....	90.0
47	24,000-31,000	....	5-15	....	....	....	....	13.0	....	....	87.0
100	12,000-14,000	4,000	15-25	25	....	....	....	....	....	....	99.0
109	20,000-28,000	15,000	0-1.5	70	12.0	....	....	....	....	....	88.0
112	19,000-24,000	11,000	1-2.5	65	7.5	....	....	....	1.5	1.2	89.8
122	35,000-40,000	20,000	0-1.0	115	10.0	....	0.25	....	....	1.2	88.55
142	30,000-40,000	25,000	0.5-2.0	100	4.0	2.0	1.5	....	....	....	92.5
145	25,000-37,000	12,000	3-6	65	2.5	....	....	....	10.0	1.2	86.3
195HTT-4	28,000-35,000	13,500	6-12	65	4.0	....	....	....	....	....	96.0
195HTT-10	36,000-50,000	27,000	0-5	100	4.0	....	....	....	....	....	96.0
195HTT-16	30,000-40,000	21,000	3-8	75	4.0	....	....	....	....	....	96.0
196	33,000-45,000	27,000	0-2.5	110	5.0	....	....	....	....	....	95.0

1. The most popular alloys given in this table are Nos. 12 and 112, but these are not suitable for castings that must be leak-proof and pressure-tight.

2. Alloy No. 109, having 12 per cent copper, makes pressure-tight castings, but has less shock-resistance and is not suitable for severe impact stresses.

3. For castings subject to wear, alloy No. 122 should be used.

4. Alloy No. 195 is obtained in three different heat-treatments. No. 195HTT-4 ages at ordinary temperatures. After a period of several weeks, the tensile strength will show an increase, the yield point will increase as much as 50 per cent, and the elongation will decrease. Similarly, an increase in tensile strength resulting from precipitation heat-treatment at 960 degrees F. for twelve hours and quenching in hot water

is accompanied by an increase in yield point and a decrease in elongation. The corrosion-resistance of this alloy is superior to that of alloy No. 112 and is comparable with alloy No. 43, which is one of the most resistant of aluminum casting alloys.

5. Alloy No. 196 develops a higher Brinell hardness than No. 195.

6. The silicon alloys form dense, pressure-tight castings and pour readily into intricate thin sections, but they readily pick up iron from remelting equipment, which lowers the elongation, and they all have a relatively low yield point in comparison to their ultimate tensile strength. All these alloys have specific gravities less than that of aluminum.

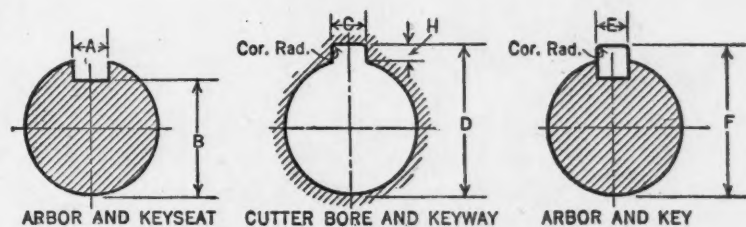
Alloy No. 142, developed in England as the "Y" alloy, is intended especially for use at elevated temperatures.

*Compiled by the High Pressure Tank Car Department of the General American Tank Car Corporation.

MACHINERY'S Data Sheet No. 213, New Series, November, 1931

KEYSEAT, KEYWAY, AND KEY DIMENSIONS FOR MILLING CUTTERS AND ARBORS*

Approved by American Standards Association, April, 1930



Diam. Arbor	Nom. Size Key (Square)	Arbor and Keyseat				Bore and Keyway†					Arbor and Key†			
		A		B		C		D	H	Corner Radius	E		F	
		Max.	Min.	Max.	Min.	Max.	Min.	Min.	Nom.		Max.	Min.	Max.	Min.
1/2	3/32	0.0947	0.0937	0.4531	0.4481	0.106	0.099	0.5578	3/64	0.020	0.0932	0.0927	0.5468	0.5408
5/8	1/8	0.126	0.125	0.5625	0.5575	0.137	0.130	0.6985	1/16	1/32	0.1245	0.1240	0.6875	0.6815
3/4	1/8	0.126	0.125	0.6875	0.6825	0.137	0.130	0.8225	1/16	1/32	0.1245	0.1240	0.8125	0.8065
7/8	1/8	0.126	0.125	0.8125	0.8075	0.137	0.130	0.9475	1/16	1/32	0.1245	0.1240	0.9375	0.9315
1	1/4	0.251	0.250	0.8438	0.8388	0.262	0.255	1.104	3/32	3/64	0.2495	0.2490	1.094	1.088
1 1/4	5/16	0.3135	0.3125	1.063	1.058	0.325	0.318	1.385	1/8	1/16	0.3120	0.3115	1.375	1.369
1 1/2	3/8	0.376	0.375	1.281	1.276	0.410	0.385	1.666	5/32	1/16	0.3745	0.3740	1.656	1.650
1 3/4	7/16	0.4385	0.4375	1.500	1.495	0.473	0.448	1.948	3/16	1/16	0.4370	0.4365	1.938	1.932
2	1/2	0.501	0.500	1.687	1.682	0.535	0.510	2.198	3/16	1/16	0.4995	0.4990	2.188	2.182
2 1/2	5/8	0.626	0.625	2.094	2.089	0.660	0.635	2.733	7/32	1/16	0.6245	0.6240	2.718	2.712
3	3/4	0.751	0.750	2.500	2.495	0.785	0.760	3.265	1/4	3/32	0.7495	0.7490	3.250	3.244
3 1/2	7/8	0.876	0.875	3.000	2.995	0.910	0.885	3.890	3/8	3/32	0.8745	0.8740	3.875	3.869
4	1	1.001	1.000	3.375	3.370	1.035	1.010	4.390	3/8	3/32	0.9995	0.9990	4.375	4.369
4 1/2	1 1/8	1.126	1.125	3.813	3.808	1.160	1.135	4.953	7/16	1/8	1.1245	1.1240	4.938	4.932
5	1 1/4	1.251	1.250	4.250	4.245	1.285	1.260	5.515	1/2	1/8	1.2495	1.2490	5.500	5.494

*All dimensions given in inches. †Note: A difference between the over-all cutter bore and keyway D and the arbor and key dimension F, of 0.010 inch for arbor diameters up to 2 inches, and 0.015 inch on arbor diameters larger than 2 inches, is allowed.

MACHINERY'S Data Sheet No. 214, New Series, November, 1931

MACHINERY, November, 1931—200-A

PROPERTIES AND COMPOSITION OF SANDCAST ALUMINUM ALLOYS

Alloy	Si	Fe	Cu	Mn	Mg	Zn	Ni	P	S	Temp. (°C)	Yield (kg/cm²)	Tensile (kg/cm²)	Elong. (%)
1	10	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	10	15	10
2	12	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	12	18	12
3	14	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	14	20	14
4	16	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	16	22	16
5	18	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	18	24	18
6	20	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	20	26	20
7	22	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	22	28	22
8	24	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	24	30	24
9	26	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	26	32	26
10	28	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	28	34	28
11	30	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	30	36	30
12	32	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	32	38	32
13	34	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	34	40	34
14	36	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	36	42	36
15	38	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	38	44	38
16	40	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	40	46	40
17	42	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	42	48	42
18	44	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	44	50	44
19	46	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	46	52	46
20	48	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	48	54	48
21	50	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	50	56	50
22	52	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	52	58	52
23	54	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	54	60	54
24	56	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	56	62	56
25	58	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	58	64	58
26	60	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	60	66	60
27	62	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	62	68	62
28	64	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	64	70	64
29	66	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	66	72	66
30	68	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	68	74	68
31	70	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	70	76	70
32	72	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	72	78	72
33	74	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	74	80	74
34	76	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	76	82	76
35	78	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	78	84	78
36	80	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	80	86	80
37	82	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	82	88	82
38	84	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	84	90	84
39	86	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	86	92	86
40	88	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	88	94	88
41	90	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	90	96	90
42	92	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	92	98	92
43	94	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	94	100	94
44	96	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	96	102	96
45	98	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	98	104	98
46	100	0.5	0.1	0.05	0.05	0.05	0.05	0.01	0.01	200	100	106	100

The following table gives the properties and composition of sandcast aluminum alloys. The alloys are designated by numbers 1 to 46. The composition is given in percent by weight. The properties are given in kg/cm² and percent elongation. The temperature is given in °C.

1. The alloys are sandcast. 2. The alloys are designated by numbers 1 to 46. 3. The composition is given in percent by weight. 4. The properties are given in kg/cm² and percent elongation. 5. The temperature is given in °C.

MACHINE & TOOL CO. LTD. 213 and 215

REVERSE ENGINEERING OF MACHINE TOOLS AND ABBE



Machine	Tool	Abbé	Reverse Engineering
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
10	10	10	10
11	11	11	11
12	12	12	12
13	13	13	13
14	14	14	14
15	15	15	15
16	16	16	16
17	17	17	17
18	18	18	18
19	19	19	19
20	20	20	20
21	21	21	21
22	22	22	22
23	23	23	23
24	24	24	24
25	25	25	25
26	26	26	26
27	27	27	27
28	28	28	28
29	29	29	29
30	30	30	30
31	31	31	31
32	32	32	32
33	33	33	33
34	34	34	34
35	35	35	35
36	36	36	36
37	37	37	37
38	38	38	38
39	39	39	39
40	40	40	40
41	41	41	41
42	42	42	42
43	43	43	43
44	44	44	44
45	45	45	45
46	46	46	46

Multi-Slide Tools for Making Intricate Parts

By F. C. DUSTON

Piercing, Embossing,
Blanking and Form-
ing Tools Designed
for Producing Small
Bronze Parts on a
Multi-Slide Machine

THE development of the multi-slide machine described in *MACHINERY* for September and October, pages 25 and 102, has made it possible to produce intricate parts such as shown at *D*, Fig. 1, at the rate of 125 pieces per minute. This particular part is a connector designed to make a spring contact with the familiar cap at the top of a screen grid radio tube.

At *C* is shown a piece of strip bronze stock from which the parts *D* are made. At the right-hand end of this strip are two pierced, embossed, and blanked pieces, ready to be cut off and formed to the shape shown at *D*. The stock is obtained in

coil form and is No. 8 temper. It is 1 1/4 inches wide and 0.015 inch thick. The length of the feed required in producing this part is the same as the length of the piece, namely, 2 5/32 inches.

In Fig. 2 is shown the outline of a piece of stock that has been advanced through five positions, the blanked piece at the right being in the position in which it is cut off and formed to the shape indicated at *G*. The tool equipment of the multi-slide machine employed to perform this work is shown in Figs. 1 and 4. This equipment, and also the multi-slide machine on which it is used, was developed by the U. S. Tool Company, Inc., Ampere, N. J.

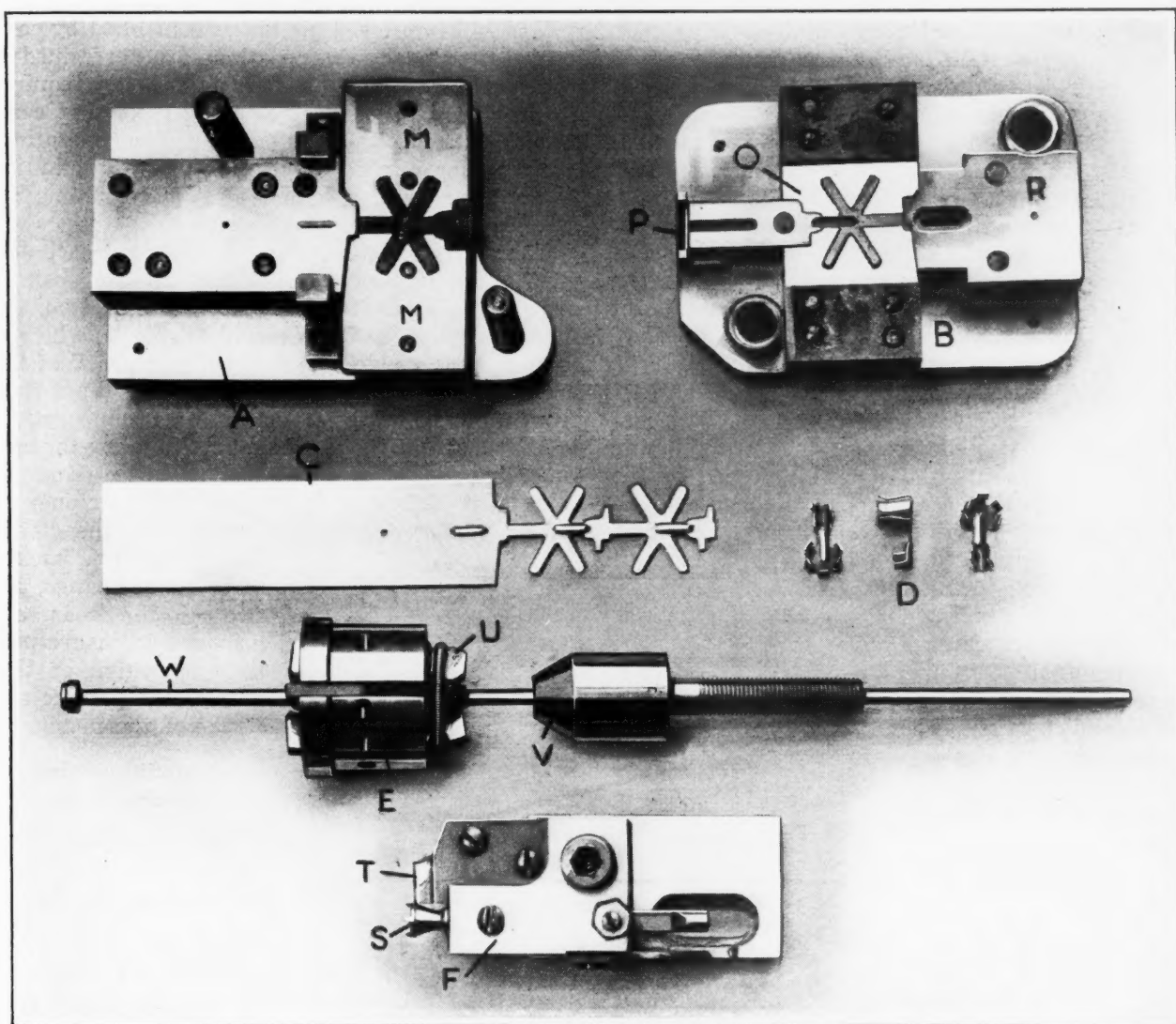


Fig. 1. Multi-slide Tool Equipment for Piercing, Embossing, Blanking, and Forming Part D

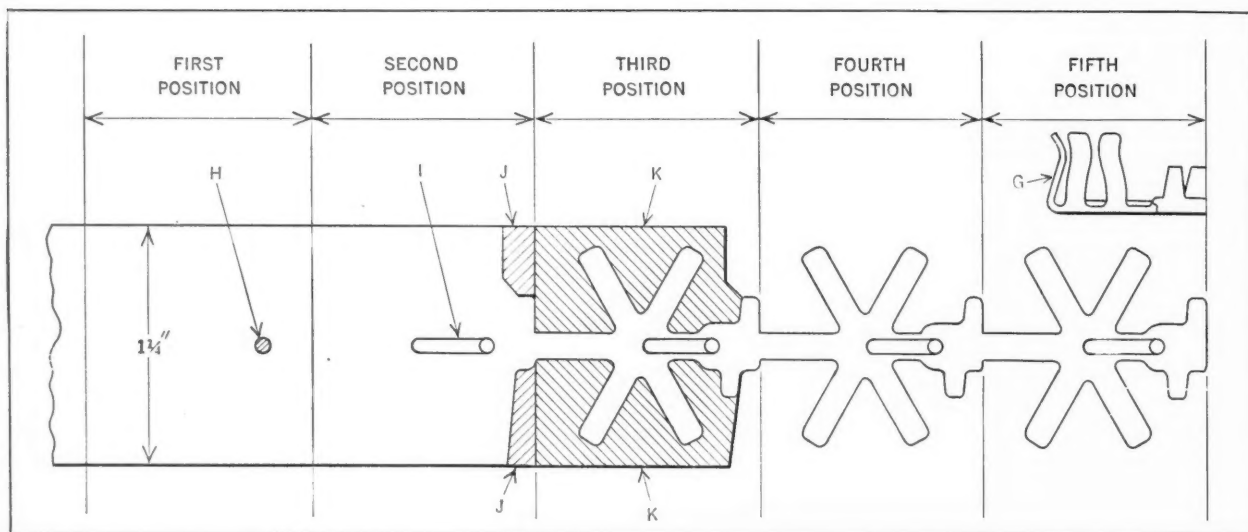


Fig. 2. Diagram Showing Operations Performed in Each Position through which Stock Passes During the Production of Part D, Fig. 1

The parts shown in Figs. 1 and 4 are indicated by the same reference letters in each view. At A is shown the stationary or die member which performs the piercing, embossing, and blanking operations, while at B is shown the punch member, which is kept in alignment with the die member by two pillars, thus forming a die set.

This unit is mounted on the multi-slide machine vertically, that is, so that the stock is fed through the die in an edgewise position. The punch is operated by a horizontal slide actuated by a cam on one of the four horizontal camshafts of the multi-slide machine. At E is shown the bending or forming die which bends the arms of the piece over the forming mandrel S of the punch.

Operation of Piercing, Embossing, and Blanking Die

After being passed through the straightening rolls of the machine, the stock is gripped by the jaws or clamps of the feeding mechanism and advanced to the first position, where the hole shown at H, Fig. 2, is pierced. While this hole is being pierced and the feeding mechanism is returning to its original position for feeding the stock to the second position, a check or clamp L, Fig. 4, operated by a cam, holds the stock securely in place. In the second position, the stock is embossed, as indicated at I, Fig. 2. The shaded portions indicated at J are also notched out while the stock is in this position.

In the third position,

the shaded portions indicated at K are notched or blanked out. The scrap stock removed by these operations is ejected into chutes below the die by means of compressed air blasts controlled by cam-operated valves. No operations are performed in the fourth position, this idle stage being required to provide space for the forming tools that come into operation in the fifth position. Thus operations are performed on three different pieces in addition to the forming of a completed part each time the stock is fed to a new position.

The stripper plates M, Fig. 1, located at each side of the blanking punch, are held in the position shown, by a spring N, Fig. 3, located in back of the bolster plate. The blanking die O, Fig. 1, which is located on the punch or movable member B of the unit, is made in two parts. These parts taper back from the center to give the die a shearing action.

At P is shown the knife that acts against the cutting edge at Q, Fig. 4, to sever the piece from the stock just before it is formed. The stripper R serves to eject the blanked strip from the die O.

This stripper is backed up by three springs, but two ejector rods are provided to insure positive operation of this member upon the return stroke of the punch.

Operation of the Forming Tools

The tools that form the part to the shape indicated at G, Fig. 2, consist of the two assemblies shown at E and F, Fig. 1. The relative positions of these assemblies are shown in Fig. 4. When the

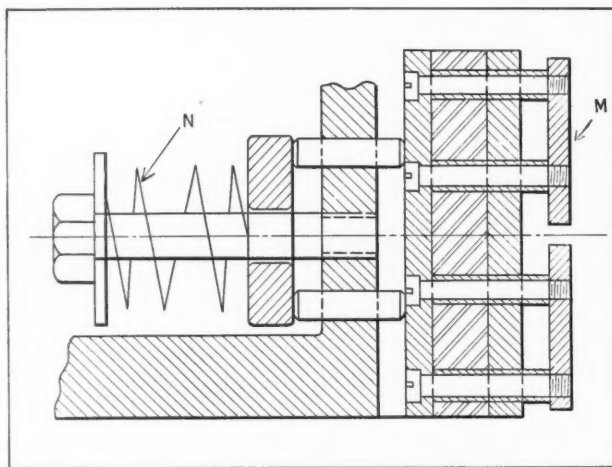


Fig. 3. Cross-section X-X, Fig. 4, Showing how Strippers M, Fig. 1, are Operated

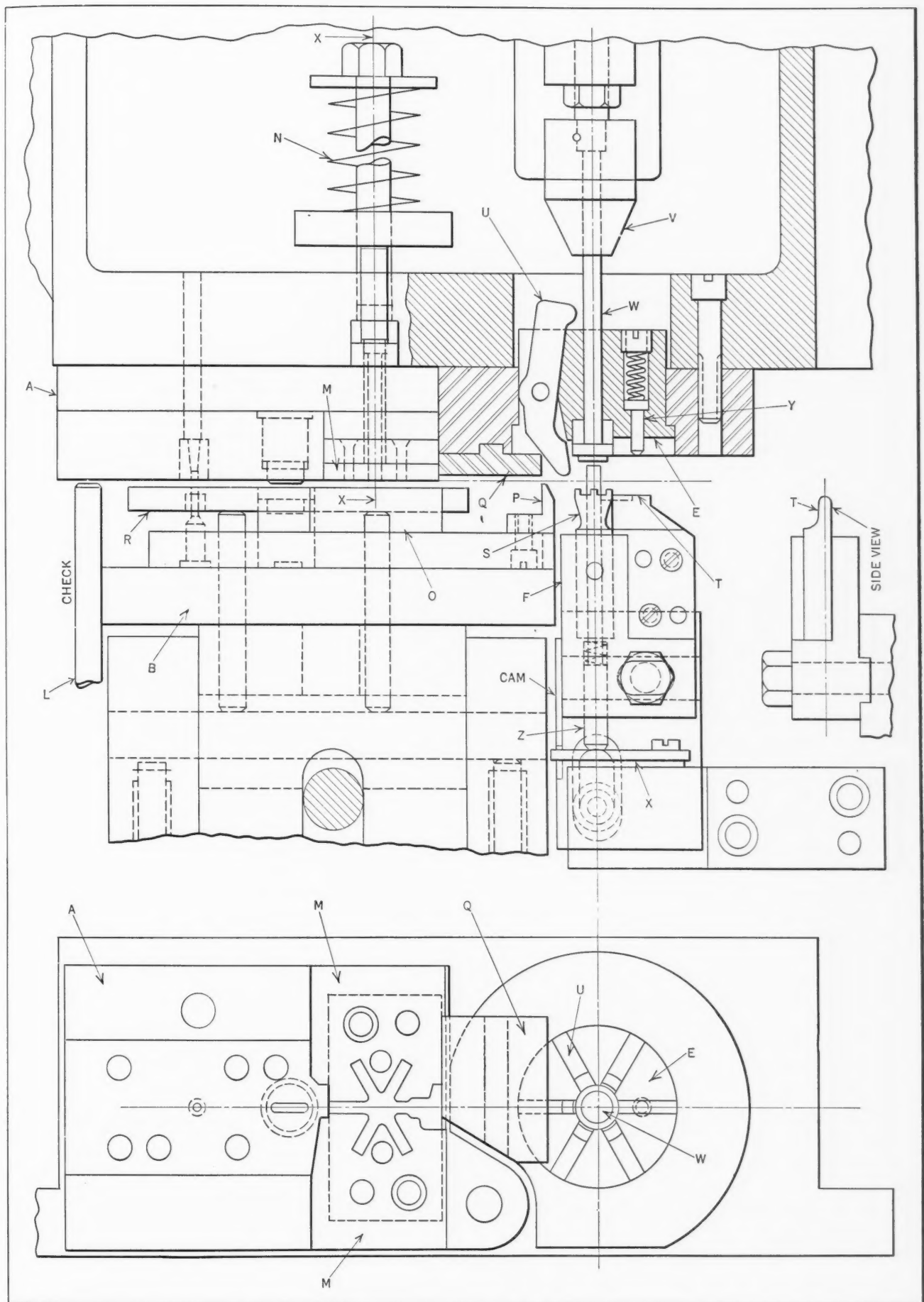


Fig. 4. Assembly Views of Die and Forming Tools Shown in Fig. 1

pierced, embossed, and blanked piece reaches the fifth position indicated in Fig. 2, it is formed over the tapered post or mandrel *S*, Figs. 1 and 4. Referring to Fig. 4, this post and the forming tool *T* advance, carrying the five arms of the part, including the one severed from the stock by the cutter *P*, into the radial slots in member *E*. The front ends of the five fingers *U* in the radial slots serve to bend the arms backward over the post *S*.

When the forming post *S* has reached the end of its inward stroke, the tapered end of the member *V* is advanced so that it comes in contact with the rear ends of the fingers *U*. Continued movement of member *V* causes the fingers to bend the arms on the work inward about the tapered post *S*. Meanwhile, the forming tool *T* carries the terminal end of the piece into a U-shaped opening or slot in member *E*. This completes the forming operations on the piece.

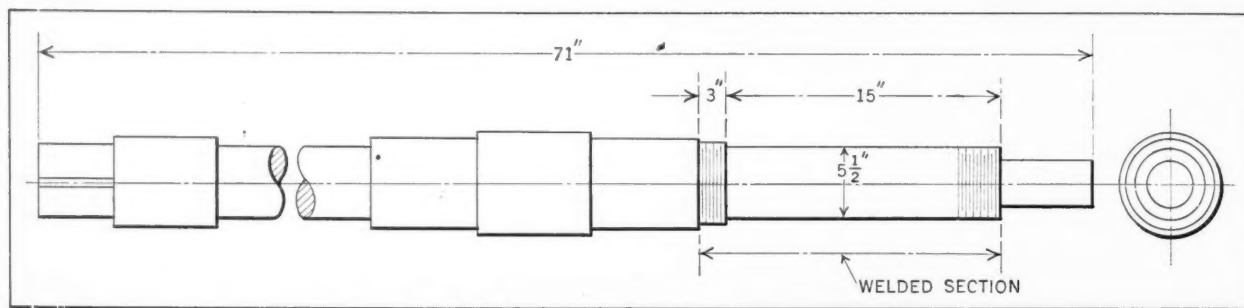
The member *V* is then withdrawn and the work ejected from member *E* by the ejecting pins *W* and *Y*. The forming post *S* and tool *T* are, of course,

Building up Worn Shafts by Arc-Welding

By H. E. HERMANN

Welding has taken a permanent place in the maintenance of equipment and is continually finding new applications in this field. Arc-welding, for example, recently saved considerable time and expense by making it possible to use two main shafts of a tire-rolling machine that had become so worn that they would not function properly. The rolling machine could not be shut down more than three days without seriously affecting the production schedule, and it was estimated that a week would be required to make new shafts. Building up the worn surfaces by arc-welding, however, proved to be a very satisfactory way out of the difficulty.

The shafts were placed on a balancing stand and revolved while building up the worn sections, in order to distribute the heat evenly around the periphery and thus prevent warping. Metal was



Shaft on which Bearing and Threaded Surfaces were Built up by Arc-welding

withdrawn simultaneously. As the slide carrying the latter members is withdrawn, the end of the ejecting pin *Z* comes in contact with the latch *X*, causing the opposite end to strip the work from the post *S*. A still further movement causes the latch to come in contact with a cam attached to the slide. This cam raises the latch and allows the ejecting pin *Z* to snap back so that the front end is flush with the end of post *S*. This leaves the work free to fall or be blown downward into the work-box by a blast of air.

* * *

One Way of Keeping Up to Date

At least once a year every general manager should procure a list of machines in use in his plant, classified by their age. Then the works manager should be requested to prove that any machine over ten years old can still be used profitably. This simple procedure would disclose many startling leakages of money in almost every plant. When these leakages have once been disclosed, progressive managements will be certain to take steps to stop them as quickly as possible.—*Carl A. Johnson, President of the National Machine Tool Builders' Association*

welded on to a depth of 3/16 inch, although results showed that just enough metal to clean up would have been sufficient. Reference to the accompanying illustration shows that there are two threaded portions on the built-up section. The threads machined on this section were practically perfect. The shafts were machined to standard size and were interchangeable with the rest of the rolling equipment. The welding time for each shaft was about seven hours.

* * *

The National Automobile Chamber of Commerce has requested the cooperation of the daily and trade press in preventing the publication of unfounded rumors pertaining to the automobile industry, particularly with regard to the announcement of new models far in advance of the time when the manufacturers are prepared to make formal announcements. Not only are these rumors frequently incorrect, but their effect on the entire industry is very serious, because these unfounded rumors interfere greatly with the normal business of the automobile manufacturers. *MACHINERY* has never given space to mere rumors or conjectures, and is heartily in favor of the action of the National Automobile Chamber of Commerce.

Grinding Flat and Concave Surfaces on Plates

Attrition mill plates, such as shown in Fig. 1, present an interesting grinding problem. These chilled-iron plates are segments of a ring having an outside diameter of 36 inches and an inside diameter of about 17 inches. Six of these plates make

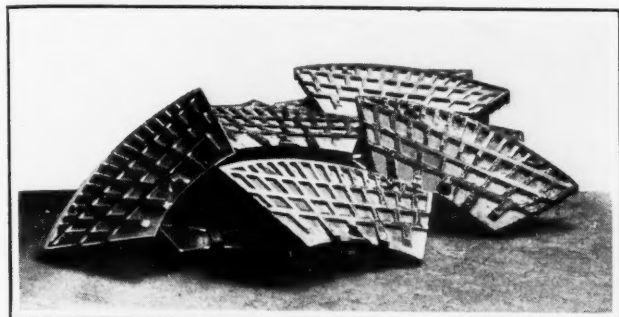


Fig. 1. Attrition Mill Segment Plates

one complete ring, and two of the rings, or twelve plates, are used in each mill. In the mill the plates *C*, Fig. 3, are mounted on disks *D*, fastened to two separate shafts. The material to be ground is fed to the center through an opening *A* in one of the disks and passes outward between the ribbed surfaces of the plates. It is cut into fine particles by the sharp edges of the ribs on the plates, which are rotated at high speed in opposite directions. When sufficiently reduced in size, the material escapes at *B*.

The clearance at *B* must be uniform, the grinding ribs must have sharp corners, and the inner part of the face must be concave and the outer part flat. These features are obtained by grinding on a Blanchard vertical surface grinder, equipped with a magnetic chuck and with special means for quick adjustment for concave grinding.

The first operation is to grind the back of the plates flat, as shown in the upper view, Fig. 2. The

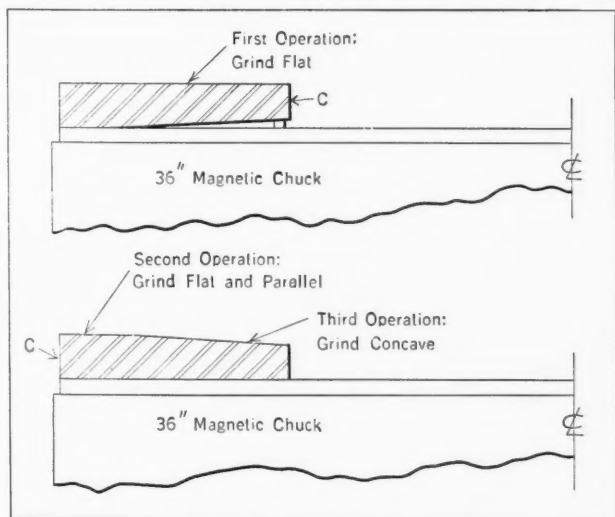


Fig. 2. How Segments of Attrition Mill Plates are Ground on Vertical Surface Grinder

plates are then turned over, and the second flat grinding operation finishes the outer part of the face, as shown in the lower view. Without removing the plates from the grinder, the column and head of the machine are tilted quickly to produce the desired amount of concavity, and the third grinding operation is performed. Sometimes plates are ground with two concave portions, the central part having a steeper angle than the intermediate one, and the outer portion of the face being flat, as before. The quick tilting adjustment on the grinder provides for duplicating these settings rapidly, so that a set of plates can be completed without removing them from the machine.

* * *

Improved Pickling Method

Recent improvements in pickling methods are claimed to effect a considerable saving in labor, time, and pickling acid, as well as to produce a superior surface for galvanizing. The new method is used for drop-forgings, stampings, and hardware in general that requires galvanizing.

The work is first charged into a drum lined with Goodrich Rubber Co.'s Triflex lining, 9/16 inch thick, vulcanized to the shell. The drum rotates at 6 revolutions per minute, gently agitating the work in a flowing bath of sulphuric acid. The work remains in the drum until the pickling is completed. By reversing the direction of rotation of the drum, the work is discharged from the pickling section into a continuous screen section, where it is drained.

The work then passes into a third section, where it is subjected to a spray of regular city water. After a thorough rinse, the work passes to a fourth section where it is immersed in a fluxing solution of zinc chloride or muriatic acid. It is then discharged on a hot plate, where it is left to dry. The equipment used for this new pickling process is built by N. Ransohoff, Inc., Cincinnati, Ohio.

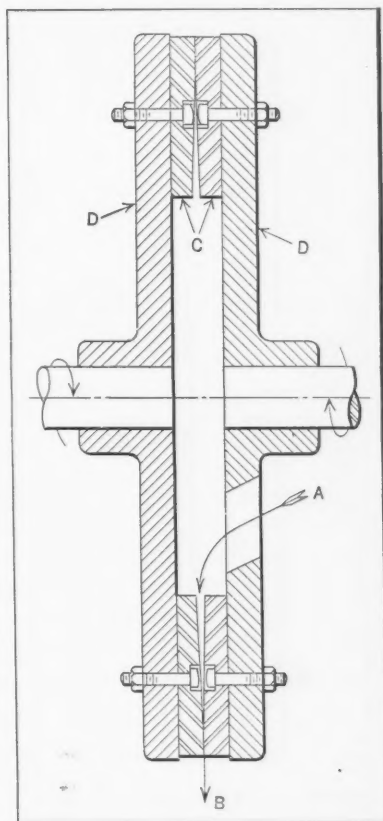


Fig. 3. Assembly of Attrition Mill Plates *C* on Their Driving Disks

Determining Stresses in Helical Springs

By J. W. ROCKEFELLER, Jr., Consulting Engineer, New York

IN the formulas commonly employed for the calculation of stresses in helical springs, it is assumed that the stress is equal to the shearing stress produced in a straight rod acted upon by a twisting force, the moment arm of which is equal to the mean radius of the spring coil.

For many years, these formulas have been depended upon to give at least approximately accurate stress figures. Nevertheless, it has been found that in the case of closely coiled springs, failure often occurred at loadings below the calculated strength. Accordingly, many designers adopted the practice of modifying the common formulas by the application of a correction factor empirically determined.

In a helical spring the neutral axis of shear does not exhibit coincidence with the geometric center of a cross-section, as in the case of a straight rod. The closer the spring is coiled, that is, the smaller the ratio of helix diameter to wire diameter, the greater the distance between the geometric axis and the neutral axis of shear, and the greater the inaccuracy of the common stress formula.

In the accompanying chart for determining spring stresses, Wahl's stress multiplication factor has been applied to correct the usual discrepancy, and it will be found that even for very closely coiled springs, the stress given is accurate within quite close limits.

The horizontal lines on the chart indicate the mean coil diameter of the spring, in inches. The oblique lines show the size of wire, in the Washburn and Moen gage. The vertical lines show the stress, in thousands of pounds per square inch, under a load of one hundred pounds (at top of chart) or of one pound (at bottom of chart).

As an example, let us find from the chart the fiber stress in a spring coiled from No. 8 wire (0.162 inch in diameter) with a mean coil diameter of 0.7 inch, under a load of 150 pounds. It will be found that the No. 8 oblique line and the "0.7 inch" horizontal line intersect at the vertical line indicating a stress of 58,000 pounds per square inch under a load of 100 pounds. The stress, then, under a load of 150 pounds, would equal 87,000 pounds per square inch.

The Photo-Electric "Eye" in a Steel Mill

Steel bars, as they pass from the rolls of the rolling mill, are now being cut to the proper length by the aid of the photo-electric "eye" at the plant of the Bethlehem Steel Co., Lebanon, Pa. As the bars are still hot when they leave the rolls, they give out enough light to actuate a photo-electric tube, and thus cause the operation of a shear which cuts the bars to the required length.

The bars leave the rolls traveling at a maximum speed of 1200 feet per minute, or nearly 15 miles per hour. The photo-electric tube, part of a device furnished by the General Electric Co., is located above the path of the bar as it moves swiftly along the rolls of the "run-out" tables. When the end of the hot bar passes under the tube, the change in light sets up a weak current in the tube, which,

amplified through a relay, actuates the mechanism that cuts the bar to length. When the machine is once set, all the bars are cut off to the same length. To change the length of the cut, it is only necessary to move the photo-electric tube to another point.

* * *

The use of opaque or ground glass for the lower sections of shop windows is often desirable, but it

is not advisable unless the interior has a clear unobstructed view in some direction of, say, one hundred feet. The reason is that men working on anything requiring close attention of the eyes are likely to suffer from eyestrain if they cannot occasionally relieve the strain by focussing them on some distant object, and this cannot be done in a small room.

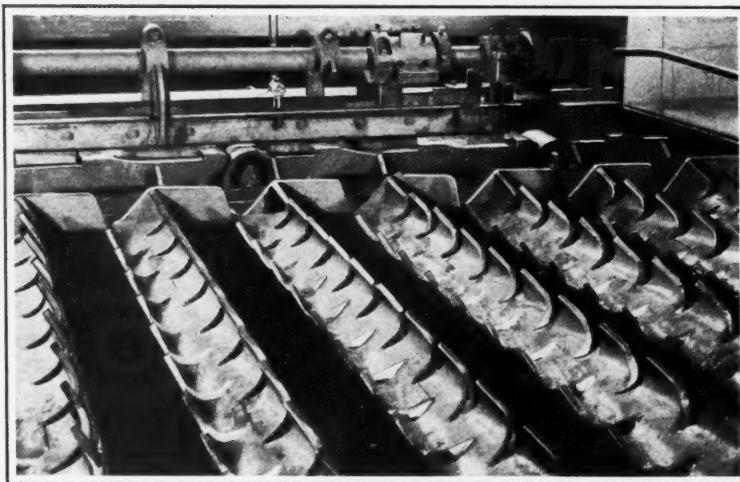


Photo-electric Relay Equipment for Operating a Shear that Cuts off Hot Bars to Length at the Bethlehem Steel Works

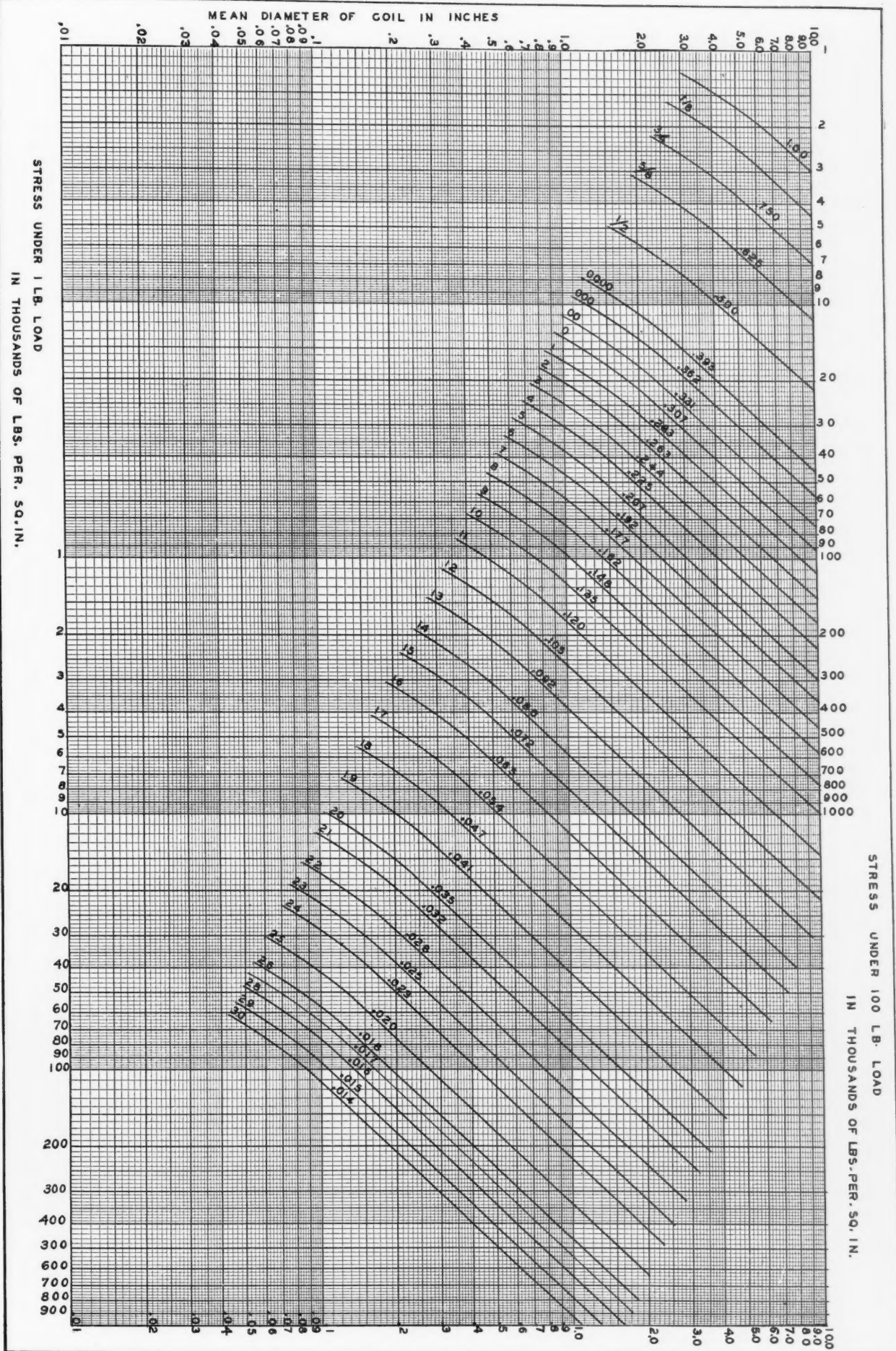


Chart for Determining Stresses in Helical Springs Wound with Wire in Sizes Ranging from 0.014 to 1 Inch in Diameter

Questions and Answers

M. N.—A factory engaged in seasonable work employed a machine shop to make certain repairs on a machine. The factory gave notice of the importance of having the repairs made promptly and properly, as the busy season was at hand, and any delay would result in great loss. The machine shop made the repairs improperly, and as a result the machine did not function as it should have. The factory had to shut down for several days and when it was able to operate again, it had to employ extra labor to keep production moving. Has the factory a right to damages from the machine shop because the repairs were improperly made?

Answered by Leslie Childs, Attorney at Law
Indianapolis, Ind.

Generally speaking, damages for the improper repair of machinery are limited to the cost of correcting the work; but where a repairer of machinery or equipment has been given special notice of the damages that will result from his neglect or failure to deliver according to contract, he may be held liable for special damages. In view of the notice served upon the machine shop when the repair contract was entered into, it is likely that the factory can recover its actual losses under a claim for special damages. (134 S. E. 343)

Power Transmitted by Stub-Tooth Gears

A. G. L.—Can the Lewis formula be used in determining the power-transmitting capacity of stub-tooth gears and, if so, how is the formula applied in the case of stub-tooth gears proportioned according to the Fellows system?

A.—The Lewis formula may be used for stub-tooth gears provided the strength or outline factor (Y) is based upon the stub tooth. A table of such factors covering both the Fellows and Nuttall systems will be found in MACHINERY'S book "Spur and Bevel Gearing," page 106.

The problem may be to determine either the power capacity of a gear of known dimensions, material and velocity, or it may be necessary to determine the pitch for a given horsepower. Both of these problems will be considered.

If H.P. = number of horsepower each gear will safely transmit; S = allowable unit stress for gear material at given velocity; A = face width in inches; Y = outline factor; P_1 = circular pitch; V = pitch-line velocity in feet per minute, then

$$\text{H.P.} = \frac{SAYP_1V}{33,000}$$

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

As this formula is based upon circular pitch, instead of diametral pitch, if the pitch of a stub-tooth gear conforms to the Fellows system, the equivalent circular pitch is inserted in the formula, as shown later by an example.

According to the original Lewis formula, the safe tangential load $W = SAYP_1$, and if these factors are substituted for W in the formula $\text{H. P.} = \frac{WV}{33,000}$, the formula just given will be obtained.

Horsepower for Given Pitch

If a stub-tooth gear of 4/5 pitch (Fellows) has 20 teeth, a pitch-line velocity V of 600 feet per minute, a face width of 2 1/2 inches, and if the working stress S is assumed to be 10,000, what is the safe capacity expressed in horsepower?

The circular pitch, according to the Fellows system, is equivalent to the diametral pitch in the numerator, or 4 in this case. The circular pitch equivalent to 4 diametral pitch is 0.7854, and the table of strength factors in "Spur and Bevel Gearing" gives a value Y of 0.121 for 20 teeth of 4/5 pitch; hence,

$$\begin{aligned} \text{H.P.} &= \frac{10,000 \times 2 \frac{1}{2} \times 0.121 \times 0.7854 \times 600}{33,000} \\ &= 43, \text{ approximately.} \end{aligned}$$

Pitch for Given Horsepower

If the horsepower formula previously given is transposed in order to find the circular pitch, we have $P_1 = \frac{\text{H.P.} \times 33,000}{SAYV}$. If we attempt to use

this formula, however, in connection with the Fellows system, the object would be to determine what circular pitch P_1 is equivalent to a diametral pitch in the numerators of one of the series of pitches; but in order to use the formula as it stands we must know the value of Y , and this cannot be determined unless we know the pitch, as well as the number of teeth. Thus we have two unknown factors and the formula may be written as follows:

$$P_1Y = \frac{\text{H.P.} \times 33,000}{SAV}$$

To show how this equation may be applied, the values in the foregoing example will again be used. Thus, the problem is to determine the pitch, according to the Fellows system, for a gear having 20 teeth, a velocity of 600 feet per minute, face width of 2 1/2 inches, and an assumed working stress of 10,000. The gear is to transmit 43 horsepower. We have then,

$$P_1 Y = \frac{43 \times 33,000}{10,000 \times 2 \frac{1}{2} \times 600} = 0.0946$$

The next step is to determine, by trial, what factor Y multiplied by the circular pitch, is equivalent to 0.0946. Referring to the table of outline factors Y , suppose we try 6/8 pitch. The circular pitch equivalent to 6 diametral pitch is 0.5236, but to simplify the work divide 0.0946 by 0.5, thus obtaining the quotient 0.189. Now by referring to all of the factors Y for 20 teeth, it will be seen that none is as high as 0.189; hence, it is evident that we should try some other pitch. Perhaps two or three trials may be necessary, but assume that 4/5 pitch is finally selected. The equivalent circular pitch in this case is about 0.78 and $0.0946 \div 0.78 = 0.121$, which is the factor Y for 20 teeth or 4/5 pitch; therefore, this pitch may be used.

If the stub tooth were proportioned according to the Nuttall system, then in this example we would know that $Y = 0.125$, because there is only one factor for 20 teeth; hence, the formula

$$P_1 = \frac{\text{H.P.} \times 33,000}{\text{SAYV}} \text{ could be used.}$$

Approximate Rule for Stub-Tooth Gears

According to an approximate rule for determining the increase in power-transmitting capacity of stub-tooth gears, as compared with ordinary gears, this increase may be determined approximately in the case of the Fellows system, merely by inverting the fraction representing the pitch and then multiplying by the horsepower capacity of ordinary gearing.

To illustrate, if a stub-tooth gear has teeth of, say, 4/5 pitch, multiply the power-transmitting capacity of an ordinary gear by 5/4 to obtain the capacity of a stub-tooth gear. Thus, if a gear of 4 diametral pitch and 14 1/2-degree pressure angle has 20 teeth, a face width of 2 1/2 inches, pitch-line velocity of 600 feet per minute, and if the working stress is assumed to be 10,000, then, according to the Lewis formula, it will safely transmit 32 horsepower. To determine the increase in strength for a stub-tooth gear of 4/5 pitch, we have $32 \times 5/4 = 40$ horsepower, which is nearly the same as the result obtained by the use of the formula and factors Y as applied to a similar example.

Delayed Deliveries

H. L. G.—On September 20, I ordered a shaper which was to be shipped F.O.B. the factory on or before January 5. In December, the manufacturer notified me that delivery would not be made on January 5, and requested additional time for delivery, which I gave him. This happened two or three times. At the approach of each date set for the shipment he wrote or wired giving an excuse and asking for additional time. The last date for shipment was set for May 1. On May 3, I wired the manufacturer to cancel the order, but I received a return wire stating that the shaper had been

loaded on the car May 2, one day after the last date for shipment had expired. I refused to accept delivery and demanded the manufacturer to return my \$850 deposit which I paid when I signed the order. Can I recover the deposit?

Answered by Leo T. Parker, Attorney at Law
Cincinnati, Ohio

I note that two days after the last date set for delivery you wired your cancellation. The shipment was made one day after the last date the delivery was promised, and one day before you wired the cancellation. In other words, the shipment was on the cars when your cancellation was received by the manufacturer. A recent case (113 So. 454) answers your question exactly. In this case a buyer ordered a machine to be delivered "about April 1." The seller failed to ship the machine at the agreed time, and on June 12, the purchaser telegraphed for information when the machine would be delivered, complaining that shipment was then about two months delayed. The seller wired that the shipment would be made on June 29. On June 30, the seller loaded the machine on a car, and had the bill of lading for the shipment signed the next day. In the late afternoon of the same day, on which the bill of lading was signed, the buyer telegraphed cancelling the order and requesting the manufacturer to return a \$450 deposit.

The telegram was not received until the next morning, which was July 2. On the day of its receipt, the seller telegraphed that the machine had been shipped, and later mailed the bill of lading to a local bank, as provided in the contract, and wrote the buyer requesting him to call there and make settlement. The machine reached its destination and remained in the possession of the railroad for some time, as the buyer refused to accept it, contending that the seller had broken the contract. The seller then sued to compel the purchaser to accept the machine and pay the balance due on it.

In holding the buyer liable for the balance of the purchase price of the machine, the Court explained the law as follows: "While there was considerable delay in making delivery, according to the contract as modified, yet, when delivery was not made in April, to which time it had been advanced, the buyer did not seek to cancel the contract, but, on the contrary, still desired it to be performed, and as late as June 12 . . . The seller had, in good faith, loaded the machine on the car for shipment, and had the bill of lading signed. Under these circumstances, we think that buyer should have accepted delivery."

Thus, it is apparent that where the date set for delivery is changed by both the buyer and the seller, the buyer's cancellation sent after the last date set for delivery must be received by the seller before the goods are loaded on the cars; otherwise the purchaser is bound to accept the shipment. This is particularly true where the machine is shipped F.O.B. the seller's plant. Therefore the \$850 deposit cannot be recovered.

Machine Tool Builders Discuss Economics

THE National Machine Tool Builders' Association met in its thirtieth annual convention at the Edgewater Beach Hotel, Chicago, Ill., October 12 to 14. The meeting was opened by the president of the association, C. A. Johnson, president of the Gisholt Machine Co. In his opening address, Mr. Johnson briefly reviewed present business conditions and called attention to the need for the replacement of old equipment in all industries to insure efficiency and reduce production costs to meet the lower price level for commodities.

Following these opening remarks, R. E. Flanders, manager of the Jones & Lamson Machine Co., in an address entitled "The Machine Tool Industry's Relation to the Business Cycle," analyzed the fundamental causes of business depressions. Most of the so-called "causes" are merely symptoms indicating the workings of far more subtle conditions, among the most important of which, the author pointed out, is the relation of the amount of savings to the amount actually invested in new enterprises. A discussion of the Swope plan for stabilizing industry followed, and a resolution relating to this plan was adopted.

W. J. Donald, managing director of the American Management Association, addressed the meeting on the subject "The Trade Association's Work for the Decade." Mr. Donald pointed out that there are limitless opportunities for cooperative action in any industry, and that there is much ground that is as yet either inefficiently covered or not covered at all. Trade association can be of much greater aid to manufacturers than is generally appreciated, and few trade associations have as yet measured up to their full possibilities. Another address that created much interest was that by John M. Carmody, editor of *Factory and Industrial Management*, who spoke on the subject "What is Going on in Russia." He gave the meeting some very interesting first-hand impressions from his recent visit to the Soviet Republic.

The Causes of the Business Cycle and Means for Preventing Future Serious Depressions were Considered at the National Machine Tool Builders' Convention



Robert M. Gaylord, President of the Ingersoll Milling Machine Co., who has been Elected President of the National Machine Tool Builders' Association

for stabilizing monetary standards.

Resolved, that while the Association approves the ideas back of the Swope plan, and will give its best thought to the task of making them effective, it

Three important resolutions were adopted by the convention, as follows:

Resolved, that we urge upon the President of the United States the desirability of calling an international conference to consider means

recognizes a serious limitation in the fact that some important factors of business fluctuations lie in the fields of finance and general public speculation, on which a due portion of responsibility must be laid. It also recognizes the difficulties imposed by the extreme fluctuations to which the machine tool business is subjected, fluctuations that are more severe than in any other line of industry for which statistics are available. We are furthermore disinclined, in view of past history, to tighten the bonds of government regulations or control.

Resolved, that while we have no expectation that the fluctuations of business are capable of complete control, we do urge a consideration of the fundamental importance of investment policies in the maintenance of business stability; calling attention

to the fact that new investment is the normal outlet for idle funds, and that courage and wisdom in their disposition may be expected to greatly mitigate the severity of a depression.

The following officers were elected: President, Robert M. Gaylord, president, Ingersoll Milling Machine Co.; first vice-president, Clayton R. Burt, president and general manager, Pratt & Whitney Co.; second vice-president, Henry S. Beal, assistant general manager, Jones & Lamson Machine Co.; and treasurer, G. E. Randles, president, Foote-Burt Co.

Three new directors were also elected: S. Owen Livingston, first vice-president, Gallmeyer & Livingston Co.; E. A. Muller, president and treasurer, King Machine Tool Co.; and H. S. Robinson, secretary and sales manager, Cincinnati Shaper Co.

Economies of Modern Furnace Installations

In a paper read before the meeting of the Society of Automotive Engineers at Boston, Mass., September 23, by E. F. Davis of the Warner Gear Co., a case was cited where carburizing costs have decreased in the last ten years from 10 cents to 9 mills per pound.

Modern carburizing furnaces with two attendants are producing today as much as twenty men with the old box-furnace methods. The present furnaces are of the return recuperative type. The boxes are pushed on roller rails the length of the furnace, after which they are pushed by a cross-pusher to an adjacent roller rail, and a rear pusher finally brings them out through the same door as the one through which they entered. The outgoing boxes give up a portion of their heat to the incoming boxes.

The furnace is entirely automatic in operation; the operator's duties consist simply of loading the boxes and unloading them after they have cooled. Carburizing cases of the following thicknesses may be obtained: 0.030, 0.040, 0.050, and 0.060 inch. The thickness of the case can be held within a variation of plus or minus 0.005 inch. The carburizing temperatures may be held within limits of 10 degrees F. Provision is also made for the mechanical handling of carburizing compound and for mixing new and old compound in definite amounts. Suction fans remove the dust.

It should be noted that a continuous furnace such as described is not intended for small jobbing shops with a wide diversity of products, but is ideal for such industries as specialize in the manufacture of a great number of similar articles—like automotive parts—where the output is more or less standardized and the production is large enough to justify the installation. These furnaces are only economical to operate when they are in continuous service, because it costs from \$30 to \$60 to bring them up to the required temperature.

* * *

Cutting Worm-Gears with Spur-Gear Cutters

The item published in October MACHINERY, page 101, pertaining to the cutting of worm-gears with spur-gear cutters brings to mind that in March, 1915, the Newark Gear Cutting Machine Co. of Newark, N. J., cut over one thousand worms using a standard Fellows spur-gear cutter, with the cutter swiveled normal to the thread helix. Our company has used this method quite a number of times since then.

In 1905, we cut worm-wheels for the Poole Engineering Co. using a spiral Fellows type cutter, with the cutter set at right angles to the worm-wheel axis. Both of these methods were used on a standard Newark gear-hobbing machine.

U. SETH EBERHARDT
Works Manager, Newark Gear Cutting Machine Co.

It Has Always Stopped Raining in the Past

The *New York American*, in its issue of October 8, published an extract from an editorial that originally appeared in *Harper's Weekly*, October 10, 1857. Apparently, it was raining very hard at that time, but the sun has been shining considerably since then. Nevertheless, the editorial written more than seventy-four years ago, reads almost as though it had been written at the present moment. Quoting from the editorial:

It is a gloomy moment in history. Not for many years—not in the lifetime of most men who read this paper—has there been so much grave and deep apprehension; never the future has seemed so incalculable as at this time. In our country there is universal commercial prostration and panic, and thousands of our poorest fellow-citizens are turned out against the approaching winter, without employment, and without the prospect of it.

In France the political caldon seethes and bubbles with uncertainty; Russia hangs as usual, like a cloud, dark and silent upon the horizon of Europe; while all the energies and influences of the British Empire are sorely tried, and are yet to be tried more sorely. It is a solemn moment, and no man can feel an indifference in the issue of events.

Of our own troubles no man can see the end. They are, fortunately, as yet mainly commercial; and if we are only to lose money, and by painful poverty to be taught wisdom—the wisdom of honor, of faith, of sympathy and of charity—no man need seriously to despair. And yet the very haste to be rich, which is the occasion of this widespread calamity, has also tended to destroy the moral forces with which we are to resist and subdue the calamity.

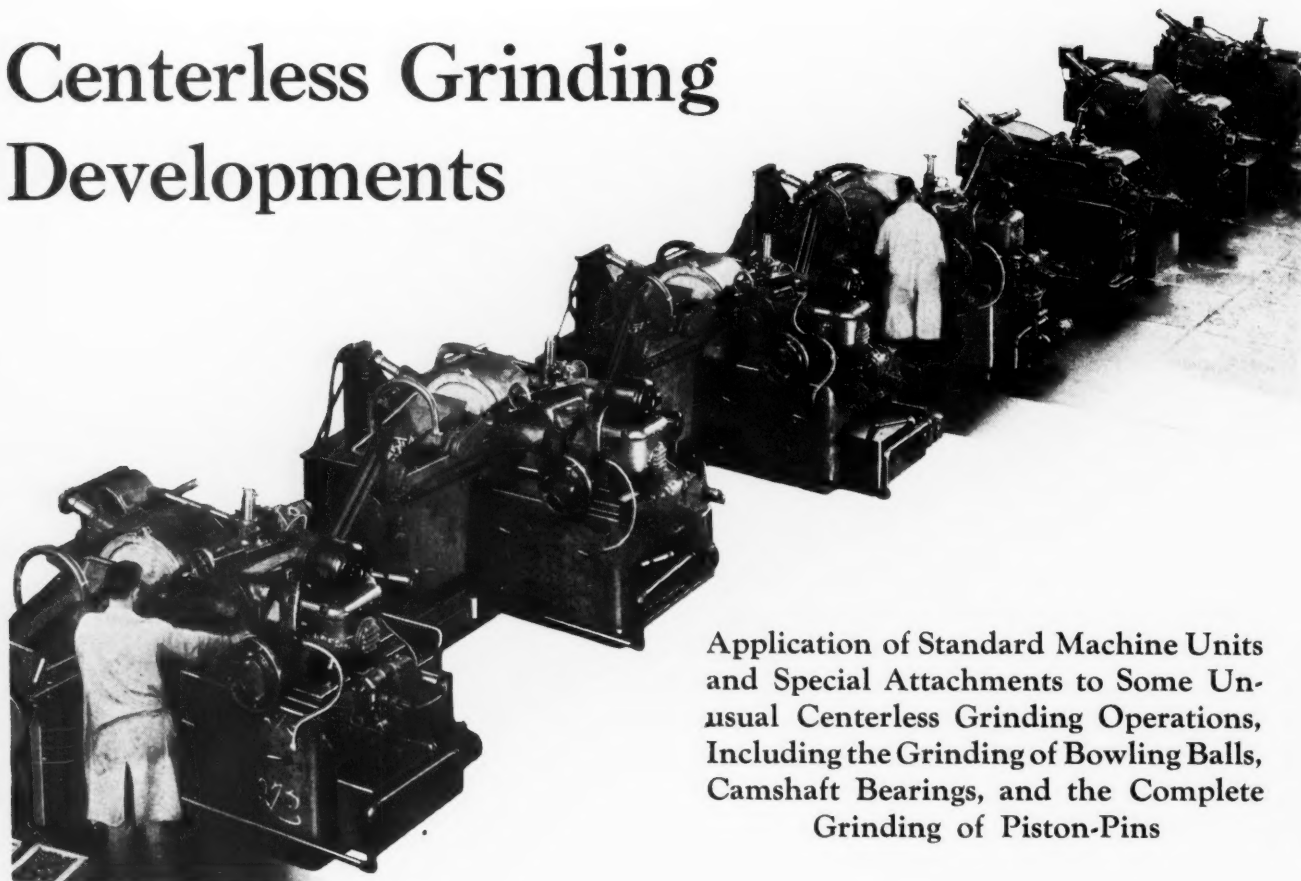
Commenting upon the editorial, the *New York American* said: "In spite of all that gloom and various Civil War panics that followed it, the United States *did come back*. And it will come back again, more prosperous than ever, and more intelligent."

* * *

Now is the Time to Make Working Conditions Safe

Among the many things that might well be done during this period of slack business is to study whether the shop has adopted all the measures for safe working conditions and sanitation that may be reasonably expected. The fifteenth annual New York State Industrial Safety Congress to be held at the Hotel Statler in Buffalo, November 16 to 18, is to be devoted to "Safety Preparedness," implying the utilization of the present period for the improvement of conditions affecting safety in industrial plants.

Centerless Grinding Developments



Application of Standard Machine Units and Special Attachments to Some Unusual Centerless Grinding Operations, Including the Grinding of Bowling Balls, Camshaft Bearings, and the Complete Grinding of Piston-Pins

SOME of the most interesting and important developments in machine shop equipment have been in the adaptation of standard machine tools or units to new and exceptional classes of work. This is done, in some instances, by equipping standard machines with special auxiliary attachments, and in other cases, by utilizing standard machine units in building equipment for special purposes. Some new applications of precision centerless grinding machines are shown here.

A job that has recently been accomplished on a precision grinding machine is the finishing of bowling balls. Fig. 1 shows a Cincinnati No. 4 centerless grinder equipped to perform this operation, which was formerly done by polishing. The productivity and economies effected by the centerless method of grinding make this new adaptation far superior to polishing. These hard rubber balls, approximately 8 1/2 inches in diameter, come to the centerless grinder after being turned. The balls are loaded singly into a hydraulic feeding attachment, which lowers each ball between the grinding and regulating wheels. Both wheels are grooved by a radial truing attachment.

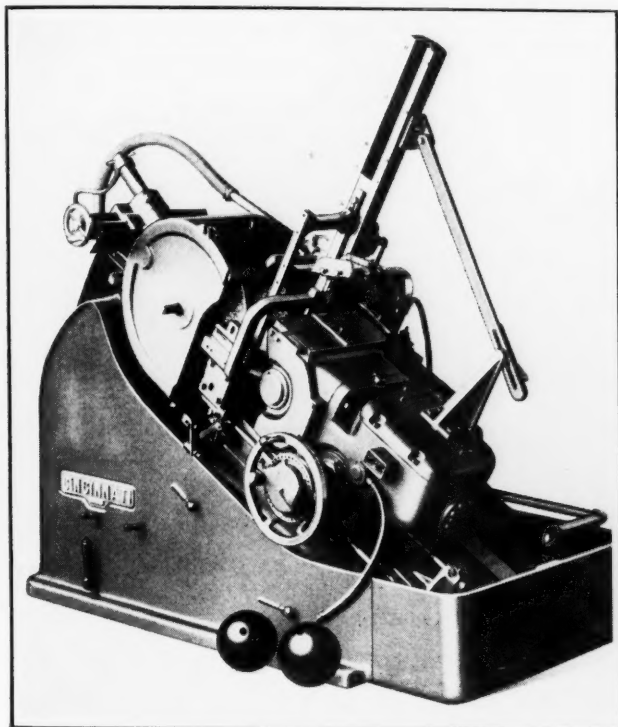
The in-feed slide carrying the work, work-rest, and regulating wheel is moved toward the grooved grinding wheel. As the work comes into contact with the grinding wheel, the ball is generated into a true sphere, since the regulating wheel is mounted on a collet at an angle of 12 degrees to the axis of the regulating wheel-spindle, which produces a constantly varying inclination of the regulating wheel

relative to the grinding wheel axis. After cleaning up the work, the in-feed slide is backed away and the hydraulic attachment raises the ball for convenient removal from the machine. Approximately 0.010 inch of stock is removed from the diameter, and a net production of thirty completely finished balls per hour is obtained. A 320-6-C6Y Aloxite elastic bond wheel is used for grinding.

The heading illustration of this article shows an outstanding grinding machine installation. This battery of centerless grinders is arranged for the complete grinding of piston-pins. The feeding of the rough pins to the first machine is followed by a succession of passes through the succeeding machines, and the pins come from the last machine finish-ground within limits of 0.0002 inch. This installation includes four Cincinnati No. 3 and three No. 2 centerless grinders all equipped with attachments for automatically sizing the work and hydraulically truing the grinding wheel. Also included in this production set-up are seven Danly Feedmatic Type E "Thru-Feed" hoppers and seven power conveyors.

The pins are dumped into the basin of the first hopper, and all the succeeding operations are automatic, thus making it possible for three men to operate the battery of seven machines. After the pins come through the first centerless grinder, they are carried up into the basin of the second hopper by the conveyor, and this method of progressive conveying and feeding continues through the entire line, with very little attention from the operators.

The automatic work-sizing attachments eliminate the necessity of frequently checking the work for size. Manual adjustment of the feed-wheel slide to compensate for wheel wear is unnecessary, this being accomplished by the sizing device which holds the work within 0.0003-inch limits. In other words, an increase of 0.0003 inch in the diameter of the work as it comes through any machine sets the automatic sizing mechanism into operation, and the correct size for the particular operation is maintained. While a variation of 0.0002 inch is allowed on pins coming through this line, less variation



**Fig. 1. Centerless Grinder
Equipped for Grinding
Bowling Balls**

than that is actually obtained, as the sizes of the pins are consistently maintained in each grinding pass.

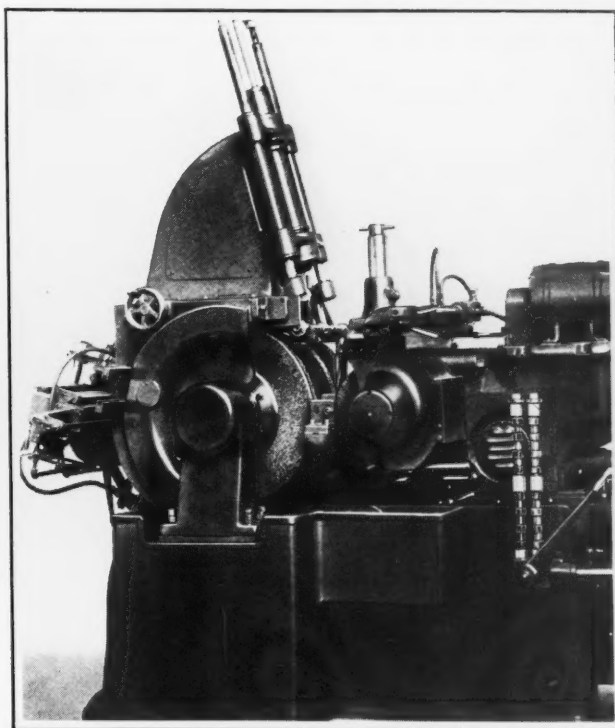
A Cincinnati No. 3 centerless grinder (illustrated in Fig. 2), with four grinding wheels and three regulating wheels, presents an improved method of grinding three main bearings and the timing-gear bearing on automotive camshafts. This new development illustrates the increasing use of special adaptations built up mainly from standard machine units. With this new equipment, the four bearings are rough-ground at the rate of ninety-five per hour. Stock removal totals 0.025 inch.

The shaft is placed on a hydraulic lowering and elevating attachment. The throwing of a single lever lowers the work between the grinding and regulating wheels and also brings the regulating wheels forward. The entire regulating-wheel housing is mounted on a base which pivots on large

trunnions below the regulating wheels. The regulating wheels are brought forward by tilting the housing, which is actuated by a cam. The cam continues to tilt the housing until the bearings have been ground to size. At the completion of the cycle, the regulating-wheel housing is lowered and the ground shaft is elevated from between the wheels. The entire operation is automatic and is controlled by a single lever.

This machine embodies special grinding and regulating wheel-heads with outboard support bearings, which give the necessary rigidity to the spindle and

**Fig. 2. Grinding Automotive
Camshaft Bearings on
Centerless Machine**



to this multiple-wheel set-up. The profiling of the grinding wheels is accomplished by a hydraulically operated fixture, the profile being determined by a cam. This fixture is arranged so that the diamond will traverse rapidly between the wheels and slow down automatically to the correct truing speed for each wheel, thereby eliminating any unnecessary delay. The same arrangement applies to the regulating wheels. Each of these fixtures is controlled by a conveniently located hand-lever.

Machine tool users who are alert and ready to adopt new machines and methods that definitely show cost reductions will find that machine tool manufacturers are anxious to cooperate fully in the development of new methods and new equipment for lowering manufacturing costs. The operations described in this article are examples of the progress that is being made continually in machine tool developments.

Milling a Spiral Groove in a Long Shaft

By E. E. KEELER

The milling of a spiral groove in two 6-inch shafts, each 25 feet long, was accomplished recently in a rather interesting manner by a job shop in Chicago, Ill. The spiral groove was required to have one complete turn in 25 feet. The first step in handling this job was to have a bar of cold-rolled steel, 1 inch square, formed to fit around a 6-inch shaft in the form of a true spiral having one full turn in 25 feet. This bar was made 26 feet long so that it extended beyond the end of the shaft in which the spiral groove was to be milled.

The spiral-shaped bar, shown at A in the accompanying diagram, was securely fastened to one of the shafts B by means of fillister-head screws C,

The spiral groove was cut to the correct depth by taking two cuts in the manner described. After completing one shaft, the spiral bar A was transferred to the second shaft, and the spiral groove cut in the same manner.

* * *

Better Packing of Highly Finished Machinery Parts

By ELTON STERRETT

The need for better packing of machinery parts is illustrated by the following incident: Recently we received a set of pump plungers designed for high-pressure work on an oil-pipe line. These plungers were made from high-grade material, were ground to a mirror-like finish, and were made to close tolerances. At this point, however, the

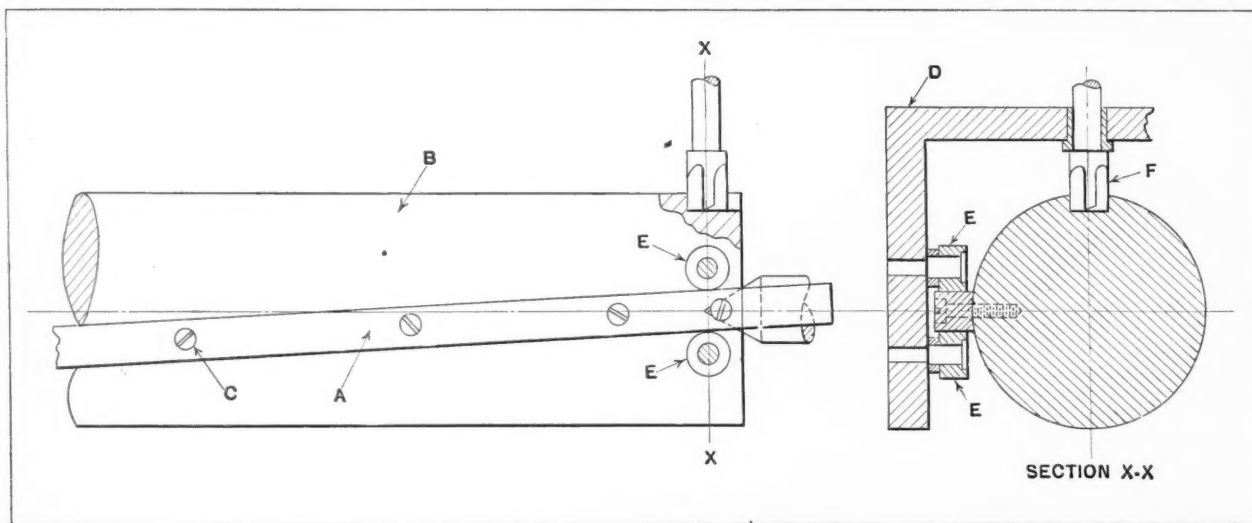


Diagram Showing Set-up Used in Milling Spiral Groove in a Long Shaft

spaced about 8 inches apart. The shaft was then placed between centers in a lathe, the faceplate first being removed so that it would not obstruct the milling equipment when starting or finishing the cut. The shaft was left free to turn on the lathe centers. A bracket D, carrying two rolls E spaced to give a snug fit for the spiral bar A, was fastened to the cross-slide of the lathe.

The horizontal center line between the two rolls E was located at the same height as the lathe centers. A large electric drill, equipped with the end-mill F, was secured to the lathe carriage in a vertical position. The end-mill was located directly over the exact center of the shaft and was so positioned that when it started to cut the groove, the two rolls E would be positioned at the end of the shaft. The shaft, being free to turn on the lathe centers, was guided or caused to turn by the spiral bar A as the carriage advanced. The longitudinal feeding movement of the table, combined with the rotary movement imparted to the work, caused the end-mill to generate the required groove.

manufacturer's interest appeared to cease. The pump plungers were slushed haphazardly with a very thin coating of anti-rust compound and were crated with the ground surfaces in contact with the crate throughout their working stroke. The crate was loaded on an open railroad car, together with heavy pump bed castings.

Upon arrival, the slush coat had been chafed away and the plungers were as rusty as if they had been at the bottom of the sea for six months. It took a competent man nearly six hours to remove the rust with emery cloth, and even then some deep pits were left. The removal of the rust affected the finish and accuracy of the plungers considerably.

Our experience has often been that the finer the workmanship, the more careless the packing; and a machine part that is in practically perfect condition when it leaves the manufacturer's plant is often spoiled by poor packing before it is actually installed in a machine.

The extreme care taken in the machine shop should be applied in the shipping room as well.

Automotive Engineers Consider Production Problems

AT the National Production Meeting of the Society of Automotive Engineers, held at Detroit, Mich., October 7 and 8, five papers pertaining to production problems in the automotive industry were presented.

J. W. Meadowcroft, of the Edward C. Budd Mfg. Co., had prepared a paper on electric welding as applied in the making of all-steel automobile bodies; C. B. Stiffler, of the Oakland Motor Car Co., read a paper on inventory control; F. P. Spruance, of the American Chemical Paint Co., dealt with the cleaning and preparation of metal surfaces; J. H. Friedman, of the National Machinery Co., covered the subject of hot, semi-hot, and cold coining methods and equipment; while J. L. Dostal, of the Holley Permanent Molding Machine, Inc., read a paper on the economic advantages of permanent molding of gray-iron castings.

The Welding of All-Steel Automobile Bodies Has Many Points in its Favor

Mr. Meadowcroft, in his paper on welding, pointed out that all-steel welded bodies for passenger cars have many advantages over composite bodies, among these being fewer parts, doors made from only two pieces, no visible outside seams, lower tops for the same head-room, less roof weight, lower center of gravity, greater safety, increased visibility, economical upkeep, and improved appearance.

The entire side of the body of a car is stamped from a single sheet, with the openings die-formed for reinforcement. The chassis frame and body follow the same lines, so that they reinforce each other, and the body sills can be omitted.

Flash-welding is employed to join sheets 120 inches long and of any required width. The tonneau rear seams are also flash-welded, while the cowl and roof are attached by spot-welding. The flash-welding of the larger sheets requires unusually accurate alignment, which is secured by a scarfing operation that trims both edges of a sheet at once.

The use of the right kind of electrodes is important. Most of the electrodes used are of copper or other material that contains a large percentage of copper. To secure long life, the electrodes are cooled to within 1/2 inch of their points, wherever possible. In a sedan body, there are 2300 spot-welds and 140 inches of flash-welding.

What Inventory Control Has Done for the Automobile Industry

Ten years ago the automotive industry kept ample stock on hand to guard against the possibility

The Welding of Automobile Bodies, Inventory Control, Coining Presses, Metal Cleaning, and Permanent-Mold Gray-Iron Castings were Among the Subjects Dealt with at the Detroit Meeting

of interrupting production because of lack of material. Stocks, both of raw materials and finished parts, were so great that considerable losses were met with in 1921 when the industry had to reduce its output materially, and new designs made old parts and materials obsolete. A study of the problem led to a system of maintaining a minimum amount of stock. Great savings have been accomplished in this way, as the turnover of materials during the year is now several times greater than formerly. Only three days' supply of many parts are now kept on hand, this being considered the minimum permissible amount. The turnover of materials and parts, as a whole, is about seventeen or eighteen times annually.

Instead of using large stock-rooms, a limited amount of space assigned for stock near the point where processing begins is now all that is necessary. As a result of these methods, the capital tied up in inventories and in buildings to house them is estimated to be only 25 per cent of what it would be if no improvements had been made in this respect during the last ten years. The cost of moving materials is only 20 per cent of the former cost.

The author quoted the following experience as an interesting example of the speed of handling materials: A carload of frames was loaded in Milwaukee on a Thursday afternoon. These frames arrived in Pontiac, Mich., Friday morning and were assembled into automobiles, of which a carload was shipped Friday afternoon to Milwaukee, so that some of these cars were delivered to retail purchasers Saturday afternoon.

Casting in Permanent Molds

Permanent molds for making gray-iron castings are made from the same iron that is poured into them. The molds are made by the use of master patterns, and are machined on their faces and coated with a refractory facing. An additional coating of acetylene smoke is applied automatically in the molding machine before pouring the hot metal into the mold. For quantity casting, twelve-head semi-automatic molding machines are used. One man pours continuously and another ejects the castings. Cores, if required, are made from sand, and are set by a third man. For small quantities, single-head machines are used. Special machines are also available for castings that are too large for a regular twelve-head machine.

Among the advantages claimed for this process are uniformity in size and hardness of castings and

freedom from sand, resulting in economy in machining; saving of space, time, and labor in making the castings; high tensile, transverse, impact, and compression strength of the castings; and the uniformly close grain and freedom from shrinkage strains. The casting and annealing operations can be controlled to give almost any desired degree of hardness. Up to the present time, 50,000,000 castings have been made by this process.

Making Forgings to Size by the Coining Process

Mr. Friedman, in his paper, dealt with the development of the coining process for producing forgings so close to size that machining is eliminated. Heavy machines producing enormous pressures are required for this work. The process is applicable both to ferrous and non-ferrous metals, and has

also been used for the straightening and sizing of malleable castings by pressure. One of the applications of this process is for connecting-rods.

At the annual production dinner held in connection with the meeting, Louis Ruthenburg, president of the Copeland Products, Inc., in a forceful address, dealt with some of the problems of the production engineer, referring specifically to the fact that the principles of good management are the same in all industries and depend upon a proper understanding of the same relationships. The idea that one industry is wholly different from another does not hold true when the problem is analyzed. Financial responsibility, an understanding of human relationships, and technical knowledge are the cornerstones on which any industrial enterprise must be built if it is expected to be successful.

Gear Manufacturers' Meeting in Pittsburgh

The fifteenth semi-annual meeting of the American Gear Manufacturers' Association was held at the William Penn Hotel, Pittsburgh, Pa., October 15 to 17. As usual, a great deal of attention was given to technical gear standardization problems; in addition, an entire day was devoted to the subject of commercial standards and practices.

The meeting was opened by the president of the Association, B. F. Waterman, of the Brown & Sharpe Mfg. Co., who briefly referred to the activities of the Association. A. A. Ross, of the General Electric Co., chairman of the General Standardization Committee, reviewed the standardization activities and outlined the progress made by each committee.

A feature of the meeting was an address made by F. W. Sinram, president, Gears & Forgings, Inc., who was the first president of the Association, an office that he held for many years. Mr. Sinram is now honorary president. He spoke on the subject, "How the American Gear Manufacturers' Association has Benefitted the Gear Manufacturer." He outlined the progress that has been made by the Association during its fifteen years of existence, and in a very comprehensive manner pointed out the additional activities in which the Association should engage, in order to be of the greatest value to the gear industry. The objectives of a trade association are very broad, and are by no means confined to technical and commercial standardization, but include practically every problem on which cooperative action is possible.

A paper entitled "The Practical Aspects of Tip Relief" was presented by T. R. Rideout of the Nuttall Works of the Westinghouse Electric & Mfg. Co., and another paper entitled "The Theoretical Aspects of Tip Relief," by R. E. Peterson of the Westinghouse company. These papers dealt with the problem of providing effective relief at the point of the tooth, especially in gears intended for

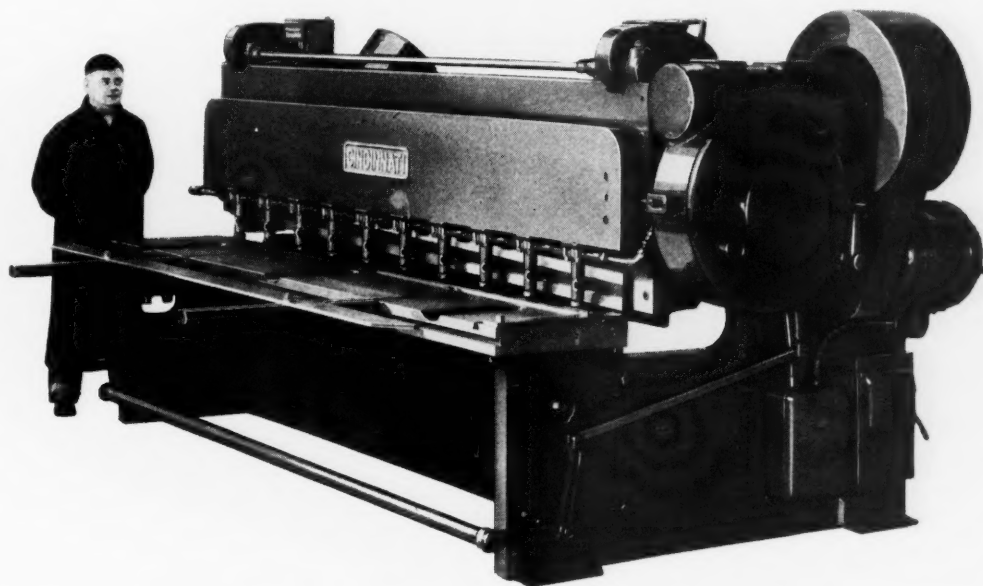
heavy duty, such as employed in street railway service, mine car construction, etc. P. C. Day of the Falk Corporation spoke on "Good Practice in the Manufacture of Speed Reducers," while J. B. Sehl, cost agent of the American Drop Forging Institute, presented an address on the subject "The Practical Application of Uniformity in Cost Practice for an Industry."

* * *

Allegheny Metal Subject of Address at Ryerson Plant

In response to invitations from Joseph T. Ryerson & Son, Inc., about five hundred manufacturers and engineers assembled at the company's plant at Jersey City, October 17, to hear G. Van Dyke, manager of the Special Steel Department of the company's Chicago works, talk on the fabrication and applications of Allegheny metal and other chrome-nickel alloys of the so-called "stainless" type. The speaker dealt with the chemical and physical properties of Allegheny metals and its fabrication, describing the methods that have proved most satisfactory in performing such operations as shearing, punching, drilling, sawing, drawing, and forming. The welding of the metal was also dealt with, the methods outlined closely following those described in an article by Mr. Van Dyke that appeared in July MACHINERY, page 875.

A large collection of commercial products fabricated from stainless steel was on display. At the conclusion of the talk, the visitors were conducted through the company's warehouses, where mechanically guided cutting torches that automatically cut heavy steel sheets into intricate machine frames were in operation, as were also the large shears and metal-cutting saws employed to cut up stock to suit customer's specifications.



New Shop Equipment

Latest Developments in Machine Tools, Unit Mechanisms, Machine Parts and Material Handling Appliances

Cincinnati All-Steel Squaring Shears with Hydraulic Hold-Downs

Unusually high speeds are claimed for a line of all-steel squaring and slitting shears equipped with hydraulic hold-downs, which are being introduced on the market by the Cincinnati Shaper Co., Cincinnati, Ohio. For example, the 3/16-inch shears of 10- and 12-foot lengths operate at sixty strokes per minute, while 1/2-inch shears of the same lengths operate at forty strokes per minute. Another important feature of these machines is that they cut straight, parallel, and square, with a high degree of accuracy. Straight and parallel cuts and square sheets are obtained without setting the squaring arm out of square or the back gage out of parallel in order to compensate for side movement of the sheets. The accuracy of these machines is attributed to several factors, the more important of which are the hydraulic hold-downs, the

low rake, and the rigidity of the all-steel construction.

The hydraulic hold-downs prevent sheet slippage by delivering a uniform clamping pressure, regardless of variations in the thickness of the sheets. The low rake or shear angle (5/16 inch per foot on the 3/8-inch, 12-foot shear) reduces distortion in the work. The rolled-steel plate construction is a feature of all main members, including the housings, upper and lower knife bars, bed, pitman links, and back brace. It is claimed that this construction makes the shears practically unbreakable and that it gives the required strength for accurate performance and the necessary rigidity for long life of the knives.

A low compact design has been obtained by extending the drive shaft behind the upper knife bar instead of above it, as in previous machines. This construction

may be seen in Fig. 1. The drive shaft pulls down on the upper knife bar by means of the pitman links. It is driven by worm-gearing enclosed in a bath of oil.

The upper knife bar is provided with a vertical adjustment which is controlled from one point. When this adjustment is in the "up" position, the knives do not pass each other at the open end, and so the shear can be used for slitting. When the adjustment is in the "down" position, the knives come together for their entire length and the machine can then be used for squaring and notching. Because of the fact that the adjustment is controlled from one point, the horizontal alignment of the knife bar can be easily maintained.

Power is transmitted from the motor to the flywheel through V-belts and thence through the silent worm-gear reduction unit to the main shaft. The clutch that meshes with the worm-wheel slides on a splined sleeve. When the clutch pin is with-

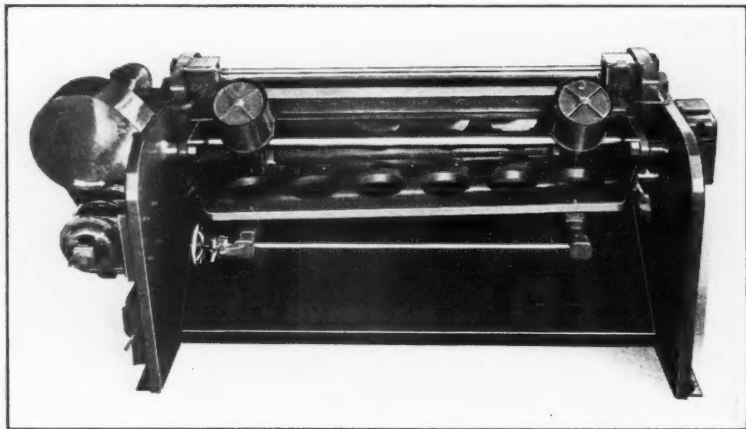


Fig. 1. Rear View of Cincinnati All-steel Shear, Showing Adjustable Back Brace

drawn by depressing the foot-treadle, a heavy spring forces the solid jaws into mesh.

The eccentric shaft passes behind the upper knife bar and pulls downward and slightly backward on the knife bar by means of the pitman links. These links are in tension, and with their back pull, hold the knife bar against hardened flat guide bearings. Spring counterbalances, arranged as illustrated in Fig. 2, pull backward as well as upward, and this arrangement also holds the knife bar against the flat guide bearings. The knife bar is held against the bearings, regardless of slide wear.

The spring devices also counterbalance the weight of the knife bar and back brace, so as to insure a smooth shearing action. They hold the upper knife bar at the top of the stroke when the clutch is disengaged, thus performing the function of a brake. The deep steel plate used for the upper knife bar may be seen in Fig. 1. Fastened to the back of the upper knife bar is a horizontal steel brace which prevents the knives from springing apart during the cut. Adjusting nuts between this brace and the upper knife bar at 12-inch intervals take care of the exact alignment of the knives.

The bed is adjustable forward or backward for obtaining the desired knife clearance. Recesses in the top of the bed permit the lower knife bolts to be reached from above. These recesses are

normally covered by a steel plate that fits flush with the top of the bed, as may be seen in Fig. 2.

The finger slots in the bed are machined to a radius so that the operator can grasp the sheets without bruising his fingers.

Adequate oiling of the machine is assured by the automatic sight-feed lubrication of all bearings and the oil bath provided for the worm-wheel and clutch assembly. Anti-friction bearings are furnished for the worm and flywheel shaft. Safety friction disks in the flywheel prevent damage to the shear from overload. These disks can be set to suit various loads.

Standard sizes of shears are available for shearing No. 10 gage, and 3/16-, 1/4-, 3/8-, and 1/2-inch sheets. The standard machine lengths are 6, 8, 10, and 12 feet, but lengths of 14 and 16 feet can also be furnished.

Norton Automatic Cam-Grinding Machine

Faster grinding of the cams on automotive camshafts, with no sacrifice of quality, is the principal feature of the automatic cam grinding machine here illustrated. This machine

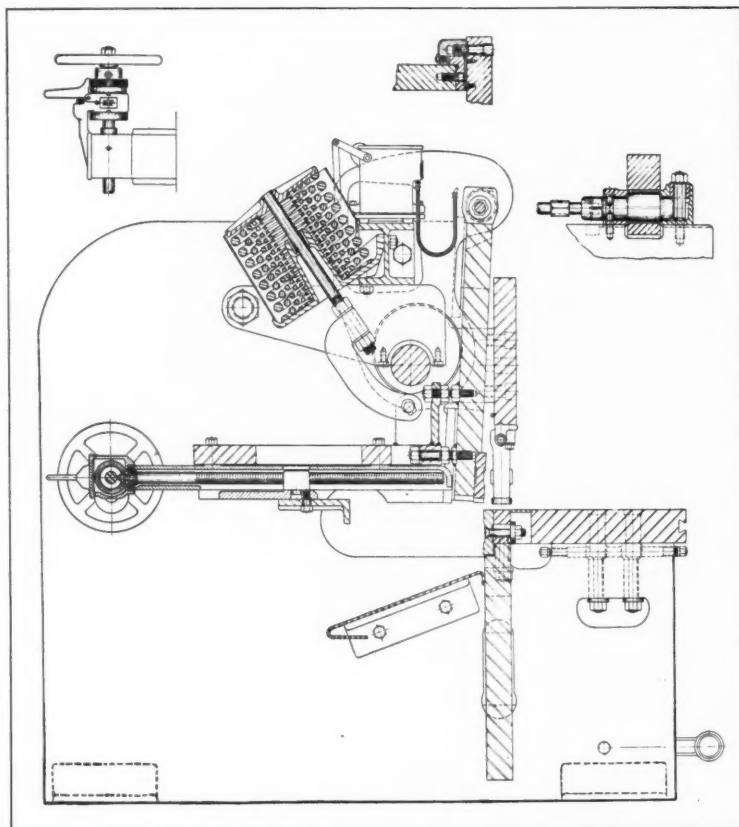


Fig. 2. Cross-section, Showing the Spring Counterbalances and Other Features of Cincinnati Shear

SHOP EQUIPMENT SECTION

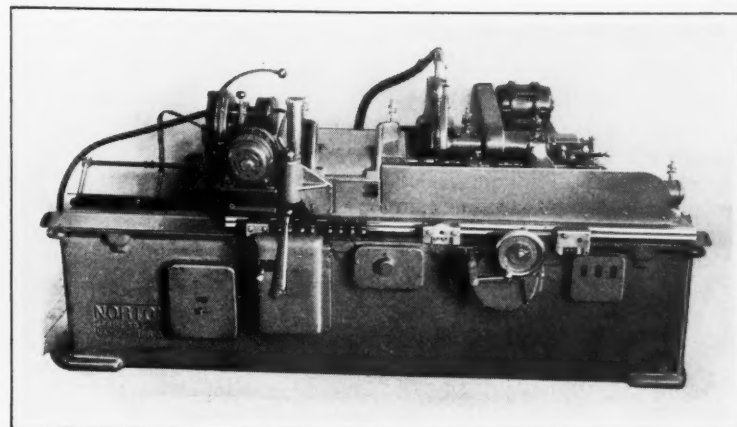
has been brought out by the Norton Co., Worcester, Mass. The cam contours are ground in essentially the same manner as with the cam grinding attachments previously considered standard equipment for such work, except that the various functions are performed automatically and more rapidly. One operator can run three or four machines, since it is only necessary to put the camshaft in the machine, start the cycle, and remove the finished work.

The grinding operation is started by pressing an electric push-button which actuates two solenoids, one of which operates a valve controlling the table movement, and the other a work-driving clutch. As the table moves to bring the first cam to be ground opposite the grinding wheel, another clutch is automatically engaged to start the grinding cycle. Three speeds are available for this cycle.

As the wheel moves forward for grinding the first cam, a master cam roller is brought into contact with the correct master cam, and a table stop-lever is tripped and positioned for the next indexing of the table. After the first cam is ground, the wheel-slide moves to its rearmost position, and the master cam and master cam roller are disengaged. Simultaneously, the table moves to the second grinding position, the master cam roller moves to the corresponding master cam, and these functions are repeated.

Successive cams along the shaft are ground in the same manner until the last cam has been ground and the wheel-slide reaches the rear position. The table then moves to the truing position, and a predetermined, but adjustable, truing speed is automatically brought into action. One pass of the diamond is made across the face of the grinding wheel, and as the table carrying the diamond reverses, the work speed is automatically reduced for a finishing cut.

There is then a second pass of the diamond across the wheel, after which the table continues to move until the last cam rough-



Norton Automatic Grinding Machine for Rough- and Finish-grinding the Cam Contours of Automotive Camshafts

ground is in front of the grinding wheel, ready for finish-grinding. Each successive cam is finish-ground in a manner similar to that employed for the rough-grinding operation until the wheel-slide reaches its rear position after finishing the last cam. The table then moves to the loading position, the revolving work is automatically stopped, and the clutch disengaged, thus ending the cycle. If desired, the machine can be used for roughing or finishing only, the cycle being so arranged that the machine stops when the table has made one pass in either direction.

The machine is driven by three motors: A 3- or 5-horsepower, constant-speed motor is mounted on the wheel-slide for driving the grinding wheel; a one-horsepower, constant-speed motor is mounted on the table for driving the work; while a third constant-speed motor of 5 horsepower is mounted at the rear of the machine base and is directly connected to the lubricant pump and the back-shaft from which the hydraulic pump and the cycle mechanism obtain their power.

The table is indexed hydraulically from one position to the next. Trip-dogs in a T-slot at the front of the machine position the table correctly for grinding each cam.

Accurate model cams are used in special machines for generating the master cams, one of which is required for each cam on the shaft to be ground. The

master cams are assembled on a spindle and ground to the correct angular relationship. The master cam-roll is mounted on a large-size shaft supported at both ends in adjustable ball bearings. Master cams can be furnished for use with grinding wheels from 22 to 24 inches in diameter or from 20 to 22 inches in diameter. The wheel-slide unit is lubricated by automatic sight-feed oilers, while the wheel-spindle bearings are flood-lubricated by a gear pump driven directly from the spindle.

Hydraulic feed is provided for moving the wheel rapidly to the grinding position and slowly during the actual grinding, the change from one speed to the other being entirely automatic. For truing, an adjustable mechanical feed is employed which is independent of the hydraulic feed. A graduated handwheel provides a manual feed when desired. While grinding, the wheel-slide rests against a stop, thus positively duplicating the location of the grinding wheel for each cam. Two stops are provided, one for roughing and one for finishing, a change from one to the other being automatically controlled between the rough- and finish-grinding operations.

The machine is made in three lengths to take camshafts 36, 42, and 48 inches between centers. The 36-inch machine weighs approximately 12,000 pounds, including standard equipment and motors.

American Hydraulic Assembly Presses

Several hydraulic presses have recently been built by the American Broach & Machine Co., Ann Arbor, Mich., for assembling the outer races of Timken roller bearings and grease retainers in automobile rear-axle housings. The ram of the press illustrated in Fig. 1 is fitted with a nose-piece on which the Timken bearing race is placed for the operation, the race being retained on the ram nose by two spring plungers. By applying pressure

on larger work. The flange fixture in this instance is of sufficient width to receive both the right- and left-hand ends of the rear-axle housings. This machine is built in 6- and 12-ton capacities. Both machines are equipped with a submerged oil-pump and a four-way distributing valve, developed by the company.

A grease retainer and a Timken bearing outer race are assembled simultaneously in the flange end of the axle housings

cylinder is uppermost and feeds the inner ram at a high speed.

In the illustration, the Timken race and grease retainer to be assembled in the axle housing are seen lying on the table. The race and grease retainer are slipped on the nose of the double ram, which is also provided with a spring plunger for holding them in position. When the operator exerts pressure on the foot-pedal, the two rams move downward and press the respective parts into their seats in the axle housing. The small ram

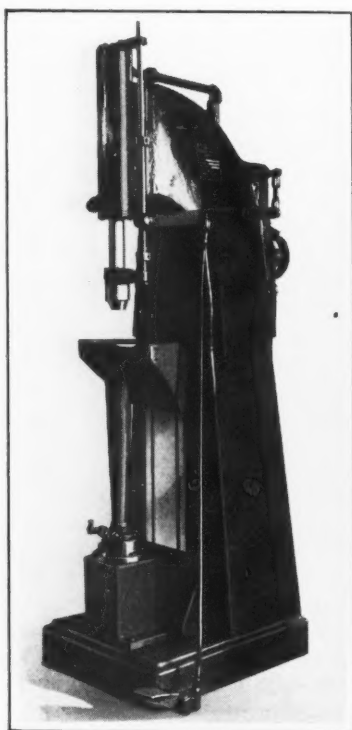


Fig. 1. American Hydraulic Press Designed for Assembling Timken Races in Axle Housings

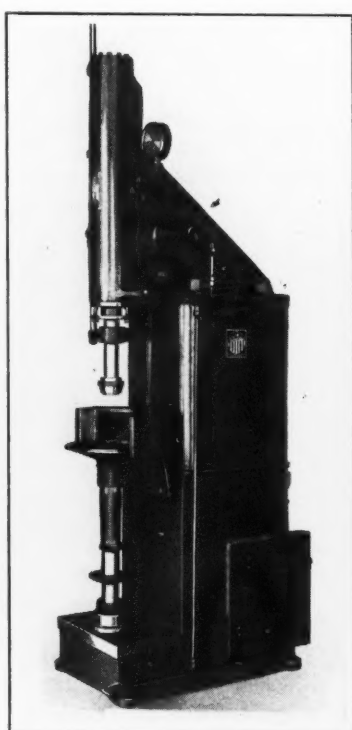


Fig. 2. Press for Performing the Same Assembling Operation on Work of Larger Size

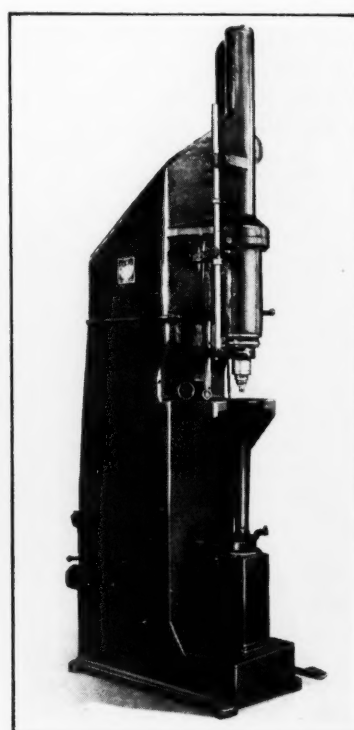


Fig. 3. Double-ram Press for Simultaneously Assembling a Bearing Race and Grease Retainer

on the foot-pedal or moving the hand-operating lever, the ram is advanced to push the bearing race into its seat in the axle housing.

This machine is fitted with a bolster having a fixture for receiving the lower end of the housing, as well as a fixture for locating the housing flange end. The machine is built in 2-, 3-, and 4-ton capacities. It operates the ram at a speed of 50 feet per minute.

Fig. 2 shows a machine arranged for a similar operation

by means of the machine illustrated in Fig. 3. This machine has two rams, one in the center of the other. Two cylinders of different diameters are mounted together. The smaller diameter

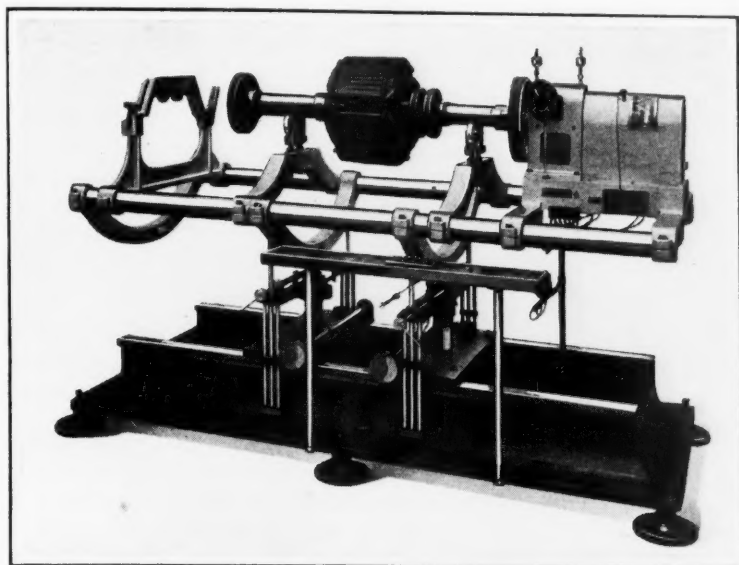
travels downward a distance of approximately 20 inches, while the outer ram moves about 6 inches. The operation requires about 10 seconds, floor-to-floor time.

Olsen-Lundgren Electrical-Spark Static-Dynamic Balancing Machine

A static-dynamic balancing machine with a capacity for handling rotors weighing from 125 to 1000 pounds was one of the exhibits of the Tinius Olsen

Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., at the National Metal Exposition recently held at Boston. This machine is suitable for dynamic-

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Olsen-Lundgren Static-Dynamic Balancing Machine for Rotors
from 125 to 1000 Pounds

ally balancing Diesel engine crankshafts, electrical armatures, fans, turbine rotors, rolls, etc. Other standard sizes handle rotors weighing from 4 to 15,000 pounds.

This balancing machine is of the same general construction as the machine described in January, 1931, *MACHINERY*, page 380. The amount of unbalance in the rotor being investigated is determined by adjusting a compensating weight while the machine is in motion, without touching the vibrating unit or disturbing in any way the functioning of the machine, until an artificial unbalance has been created in the machine that equals and is opposite to the unbalance in the rotor. The angular location of unbalance and the angular position of the compensating weight can be noted instantly by the spark dial at any time while the machine is in motion. The amount of artificial unbalance is then read directly from graduations on the compensating weight. These readings show the amount of weight that must be removed from, or added to, the rotor in order to obtain balance, and the angular location in which the correction must be made. Two readings are taken, one at each end of the rotor, so that a corrective dy-

namic couple may be applied to the part being balanced.

In the illustration, the electric motor armature to be balanced is supported on rollers attached

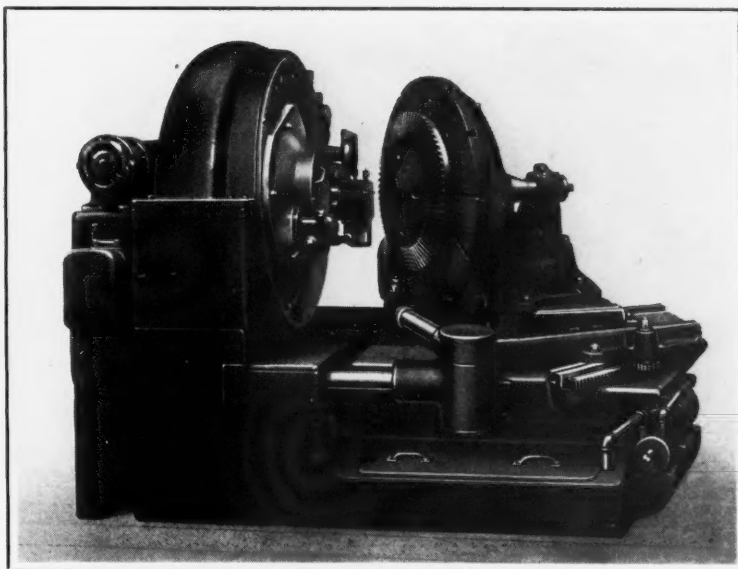
to a light, but stiff, vibrating frame constructed of aluminum-alloy cross-members and tubular steel side-rails. The adjustable artificial weight is located in the housing mounted on the right-hand end of the vibrating frame. This weight rotates on a shaft in line with the part being balanced. In determining the unbalance in a part, the part is rotated by a motor mounted in back of the housing. The entire vibrating unit may be pivoted at either of two points by operating knurled knobs at the front of the machine.

With the unbalanced part rotating and the artificial unbalance weight set to zero, the vibrating frame will oscillate horizontally on four vertical spring rods. The compensating weight is then adjusted by means of four push-buttons until oscillation or vibration of the machine ceases. The readings already mentioned can now be taken for making the necessary corrections on the part.

Gleason Spiral-Bevel Gear Planing Generator

The Gleason Works, 1000 University Ave., Rochester, N. Y., has brought out an addition to its series of large spiral-bevel gear planing generators which heretofore has comprised the 60-

and 90-inch machines. The new No. 40 planing generator has been designed to meet the demand for a machine that would cut gears beyond the capacity of the 25-inch spiral-bevel gear gen-



Gleason No. 40 Spiral-bevel Gear Planing Generator

SHOP EQUIPMENT SECTION

erator and yet not sufficiently large to warrant cutting them on the 60-inch spiral-bevel gear planing generator. If it is desired to cut hypoid gears, a special work-head can be supplied for generating the pinion in the offset position.

The machine employs a single tool and is universal within its range. The correct tooth profile is obtained by a generating action similar to that of previous Gleason bevel-gear generators. This generating action consists of a relative rolling motion between the tool-carrying cradle and the work-spindle. Change-gears provide for obtaining the correct ratios of roll for different pitch angles.

The tool is reciprocated in a straight slide by a simple crank drive, while the blank is rotated

on its axis continuously at a uniform rate. As in the larger machines of the same type, the cradle that carries the tool-slide is given a slight rocking motion, which, combined with the rotation of the blank and the movement of the tool in a straight line, produces the desired curve of the tooth across the face of the gear.

The tool cuts in a different tooth space at each stroke, so that during one revolution of the blank, the tool makes as many strokes as there are teeth in the gear or pinion being cut. The machine is completely lubricated by an automatic circulation system. It can be arranged only for a coupled drive with a 7 1/2-horsepower motor running at 1500 or 1800 revolutions per minute.

Wickes Heavy-Duty Punch and Shear

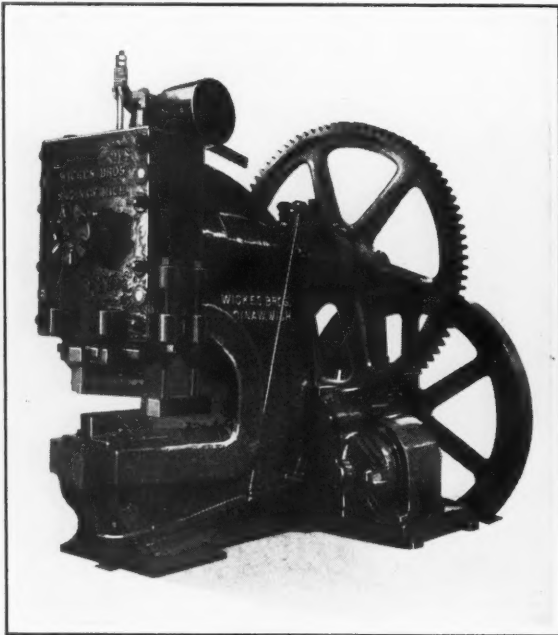
The No. 12 heavy-duty vertical punch and shear illustrated was built recently by Wickes Bros., Saginaw, Mich., for one of the large steel mills. This machine has a capacity of 500 tons applied pressure. It will shear 4 1/2-inch round steel bars, 1 1/2- by 16-inch flat steel bars,

and other structural shapes of equivalent area. The stroke of the ram is 5 inches, and the depth of the throat, 24 inches. The main punch body is a steel casting. All gears are of steel with cut teeth, except the motor pinion, which is of rawhide with bronze shrouding.

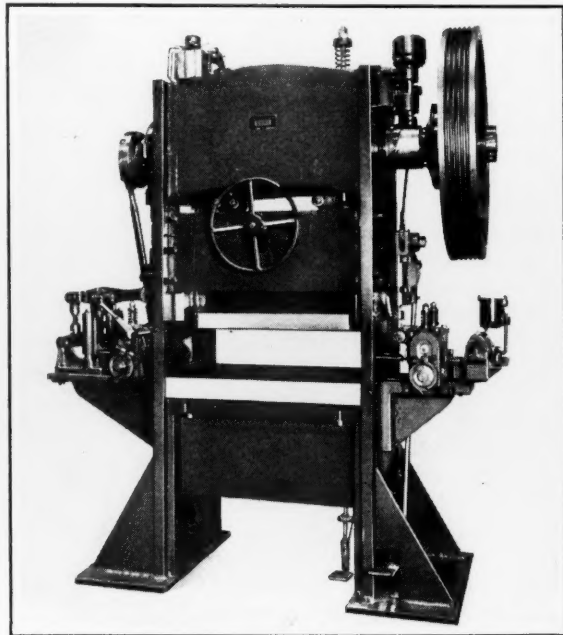
An adjustable counterweight provides for balancing the ram while using the various types of punching and shearing tools. The clutch has an attachment that allows the ram to be stopped at any desired point. A conveniently located foot-treadle permits the clutch to be engaged and disengaged at will. An electrically operated clutch controlled by a solenoid and push-button station can also be furnished. The machine is arranged for a direct motor drive by a 25-horsepower motor. The net weight of the machine, without the main drive motor and electrical control, is 54,800 pounds.

Verson High-Speed Press

A line of high-speed double-crank presses has been added to the line of Verson all-steel presses built by the Allsteel Press Co., 12015 S. Peoria St., Chicago, Ill. These presses, in conjunction with roll-feeds, stock oilers, and scrap cutters, are designed to operate continuously at speeds of 250 to 300 strokes per minute. The accompanying illustration shows a press of 60 tons capacity. This press has a bed



Wickes 500-ton Punching and Shearing Machine



Verson High-speed Press Built by the Allsteel Press Co.

SHOP EQUIPMENT SECTION

area of 24 by 36 inches, a 1-inch stroke, and a die space of 8 inches.

These presses are especially adapted for the operation of dies that require several steps to complete their work. They are of welded steel-plate construction,

and the units are practically unbreakable. The presses are provided with spring counterbalanced rams, friction clutches, force-feed lubrication, and either hand or power adjustment for the ram, depending on the size of the press.

V-belts by a three-horsepower motor. A generator of sufficient capacity for a magnetic chuck can also be mounted in the base and driven by this motor. The five-horsepower grinding-head motor and the table driving motor are separately controlled by push-buttons.

All functions of the table are controlled through a lever located in the valve panel at the front of the base. The table has an infinite number of table speeds ranging from 20 to 100 feet per minute.

The working surface of the table is 12 by 40 inches, and work 16 inches high can be accommodated. The size of the grinding wheel is 10 by 3 inches. The machine weighs approximately 7000 pounds, with the motors.

Thompson Hydraulic Surface Grinding Machine

The Thompson Grinder Co., 1534 W. Main St., Springfield, Ohio, has just developed a surface grinding machine in which the table is reciprocated hydraulically under the wheel and the wheel-head is traversed hydraulically at both ends of the table movement. The table can be reversed either automatically by dogs or manually, at any point of its stroke, while the wheel-head traverse is controlled by a valve that is instantly variable and reversible.

Cross-feeds of from 1/32 to 2 inches per table reverse are available for the wheel-head, thus providing for the fast removal of stock. The wheel-head is also equipped with a hydraulic dressing valve which permits a continuous travel of the head in either direction and at any desired speed. This valve can also

be used for traversing the head rapidly to or from the work. The grinding-wheel spindle is driven through a balanced rotor keyed direct to the spindle. The wheel-head can be raised or lowered by a handwheel on the carriage. A micrometer index permits adjustments in increments of 0.00025 inch.

The table oil-pump is located in the base and is driven through

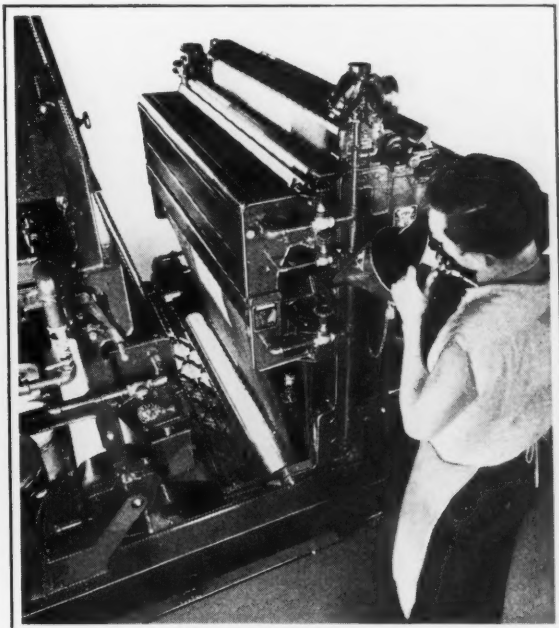
Kyano Blueprinting Process

A new process for developing blueprints and blue-line prints is being introduced on the market by the C. F. Pease Co., 822 N. Franklin St., Chicago, Ill. This process consists of running the printed paper, directly after it has been exposed, between two stainless steel rolls covered

with Kyano solution. The surplus chemical is then washed from the paper as it passes through a spray-jet water wash, and the prints are ready for drying. The use of potash can be dispensed with entirely, and this practice is recommended by the manufacturer.



Thompson Surface Grinder with Hydraulic Feeds for Table and Head



Kyano Process Attachment Applied to Pease Blueprinting Machine

The process gives a deep, rich blue from fast-printing papers, such as was formerly obtained only from slow-printing papers. All running of blues into whites is prevented, thus enabling the operator to make blue-line prints along with blueprints, and at the same printing speed. There is a sharp line of demarkation between all blues and whites, and the lines on the prints are the same width as the lines on the tracings from which they were reproduced. Because of the unusually dark blues obtained, the process has been given the trade name of Kyano, a derivation from the Greek word kyanos, which means dark blue.

A Kyano process attachment can be supplied for all continuous printing machines built by the company. Kyano chemical is furnished in dry pulverized form,

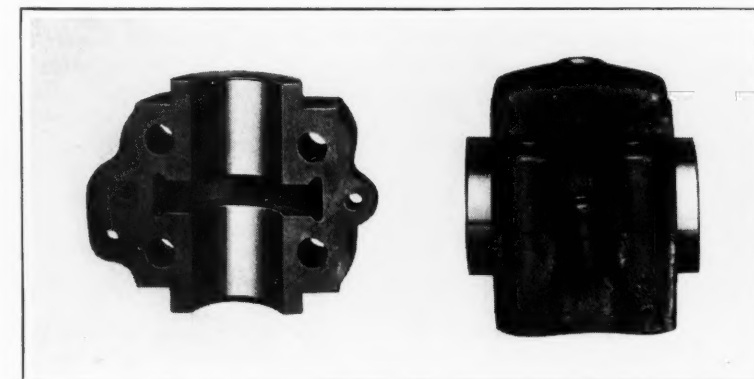


Fig. 2. Bearing Finished by the Automatic Machine Shown in Fig. 1

Rockford Automatic Drilling, Boring, Facing, and Reaming Machine

An automatic machine equipped as shown in Fig. 1 for machining the bearing illustrated in Fig. 2 has recently been built by the Rockford Drilling Machine Co., 209 Catherine St., Rockford, Ill. The surfaces finished are apparent from the view of the half-bearing at the left in Fig. 2. The production obtained with this machine has been found sufficient to enable it to replace four other machines.

together with instructions for mixing. The capacity of the tank is ten gallons, and in preparing this solution for standard operation, a sufficient quantity of the chemical should be mixed for one day's run.

the center of the bore. At the fifth station, a finish cut is taken on the recess. Finally, at the sixth station, the bore is reamed.

A direct motor drive is employed for each head through a duplex worm and worm-gear reduction and spur pick-off gears which permit speed changes to be made. A clutch controls the rotation of the spindle. All working parts within the drive are lubricated by an oil bath, and Timken taper roller bearings are used throughout.

The spindles in each head are built up into a separate unit which fits into the front compartment of the machine head and is bolted in place. The main driver of the spindle unit connects with the driver of the machine head. The spindles in this unit are also mounted in Timken roller bearings which are pro-

At the first station of the machine, the operator unloads the finished part from the fixture and replaces it with a rough part. At the second station, the part is core-drilled and rough-turned and faced on two surfaces from both ends. At the third station, the work is semi-finish-bored, finish-turned and faced, and chamfered from both ends. At the fourth station, a roughing cut is taken on the recess at

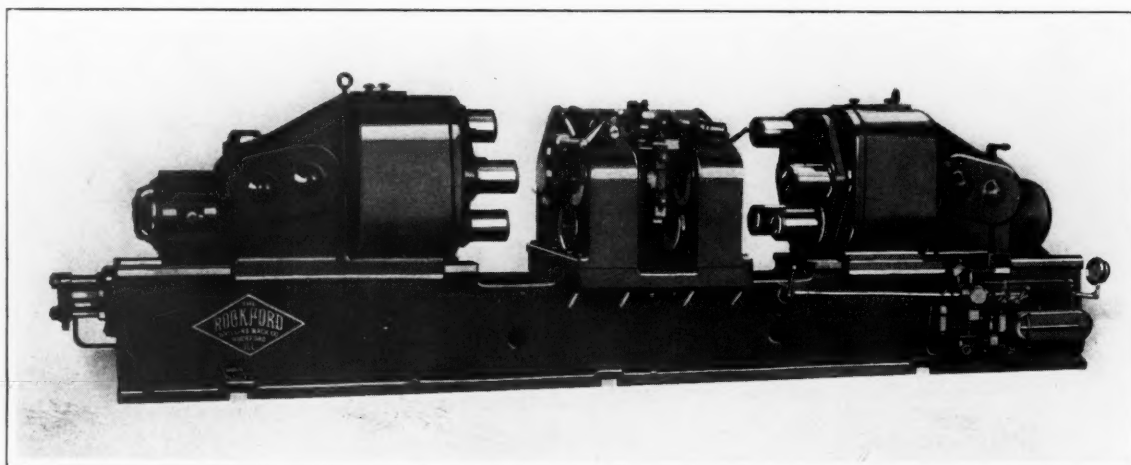


Fig. 1. Automatic Drilling, Boring, Facing, and Reaming Machine Built by the Rockford Drilling Machine Co.

vided with oil-bath lubrication. This type of construction makes possible the interchanging of spindle units to adapt the machine for changes in the part for which the machine was originally furnished or for use on an entirely different part.

Both machine heads, complete with motors and spindle units, are traversed back and forth simultaneously by means of a hydraulic pump. A completely automatic operation cycle is obtained by the engagement of a control lever. This cycle consists of a rapid forward traverse to a predetermined point where the tools are about to start working, a slow-up to the desired feed for the required distance, a dwell for the facing operation, and a rapid return traverse to the rear or starting position. The machine then stops.

The machine table is in the form of a six-sided indexing

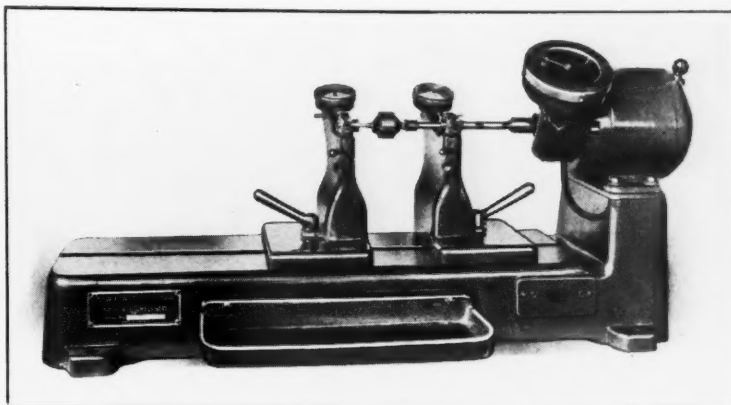


Fig. 1. Globe Dynamic Balancing Machine in which a Neon Light is Employed

drum mounted in large Timken tapered roller bearings. The table can be indexed readily by hand, and locates itself at each of the six stations. Hardened and ground steel bushings for guiding the cutting tools are incorporated in the table brackets.

location of unbalance on both sides of the work can be obtained in approximately thirty seconds.

This machine can be furnished in different sizes to balance work from 1 to 96 inches in diameter, and from 3/4 ounce to 2000 pounds in weight. Fig. 1 shows a machine for balancing small series-wound armatures, and Fig. 2 a machine for balancing large ventilating fans.

Globe Dynamic Balancing Machine

A dynamic balancing machine that uses a Neon light to locate the spot or spots of unbalance in parts has been brought out by the Globe Tool & Engineering Co., Dayton, Ohio. This "Super-sensitive" machine is particularly suitable for use in balancing small series-wound armatures, such as are used in vacuum cleaners and electric drills.

The location of the unbalancing force is found electrically by revolving the part in one direction only. The amount of unbalance is read automatically at the time that the location of the unbalance is determined. On this account the machine can be operated rapidly, it being stated that with average small work, readings of the magnitude and

Farrel-Birmingham Speed Increasing and Reducing Units

A new series of high-speed gear units has been developed by the Buffalo, N. Y., division of the Farrel-Birmingham Co., Inc.,

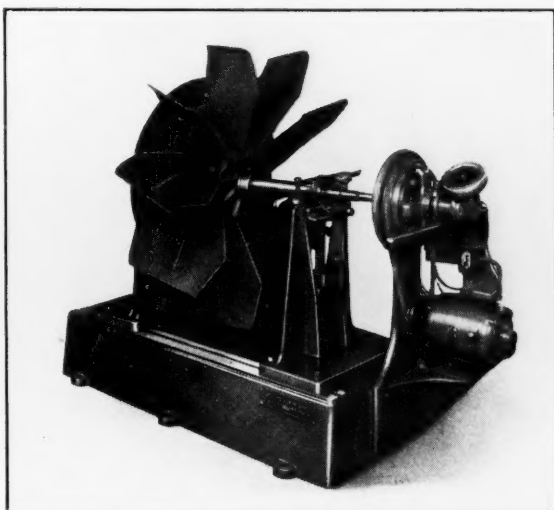
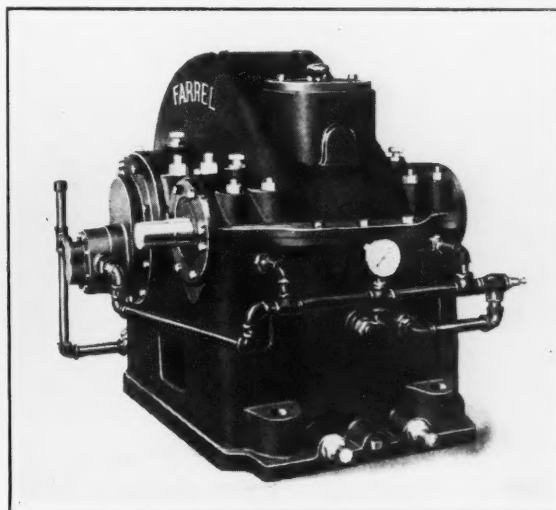


Fig. 2. Dynamic Balancing Machine Built for Determining the Unbalance in Large Ventilating Fans



Farrel-Birmingham Speed Increasing and Reducing Unit Built in High Horsepower Ratings

Ansonia, Conn., for increasing and decreasing the speed of driven units. These gear units are especially adapted for connecting Diesel or gas engines to high-speed centrifugal pumps and for similar service. They are suitable for speeds up to 6000 revolutions per minute, and are available in capacities of

from 120 to 2500 horsepower, with ratios up to 10 to 1. The gears used in these units are of the Farrel-Sykes herringbone continuous-tooth type. A complete lubrication system is provided, together with an oil cooler consisting of a coil of copper pipe located in the bottom of the gear-case.

of the feed. Crank *L* is used to revolve the table back to the starting position after the cut has been completed. Variations of speed are obtained through handle *K* which actuates a motor controller.

The rear tool can be set to depth by turning the cross-feed screw through handwheel *D*. The final adjustment for the front finish-turning tool can be made through the top slide-screw by means of lever *S* without moving the rear tool. This construction reduces the time required for changing from the rough to the finish cut, since it is only necessary to index the front tool-block.

Le Blond Spherical Turning Attachment

For rough- and finish-turning spherical surfaces, the R. K. Le Blond Machine Tool Co., Cincinnati, Ohio, has developed the attachment here illustrated. This attachment is designed to take a wide range of work, and is intended for spherical turning where accuracy and high production are desired. Centralized control and ease of set-up are features of the design.

The attachment is supported on a heavy plate-type carriage. The plate is revolved by a worm-gear drive which has a reduction ratio of 160 to 1 and gives a smooth feed. The entire operating cycle is controlled from the apron. Lever *H* actuates the multiple-disk clutch which starts and stops the spindle. Handwheel *D* is revolved clockwise to feed both the front and rear tools to the work. This result is accomplished by using a left-

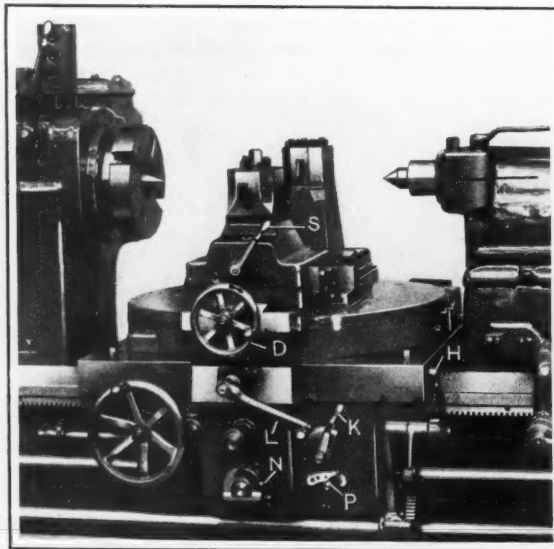
hand thread to actuate the front tool-slide, and a right-hand thread to actuate the rear tool-slide. Lever *N* actuates the positive feed clutch, and handle *P* is used to change the direction

Sleeper & Hartley Spring-Coiling Machine

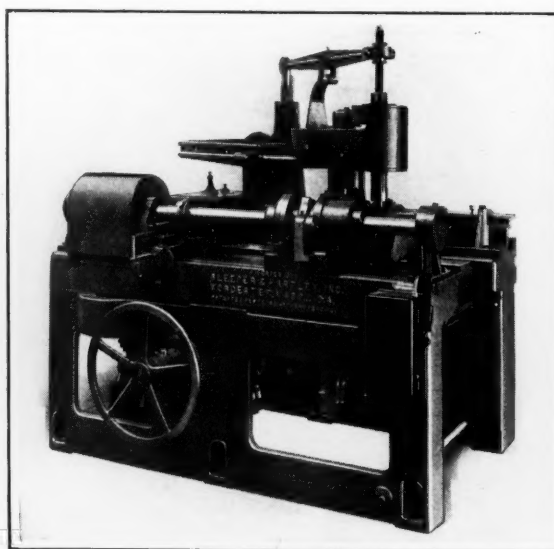
The torsion spring winding machine here illustrated is a recent development of Sleeper & Hartley, Inc., Worcester, Mass. It is designed to produce, automatically and at comparatively high speeds, springs of heavy wire with a large number of coils. Wire ranging from No. 14 (0.08 inch) to 1/4 inch can be wound into coils up to 4 inches outside diameter on this machine.

Springs in the smaller wire sizes, having up to fifty coils, can be wound at the rate of twenty per minute. In the larger

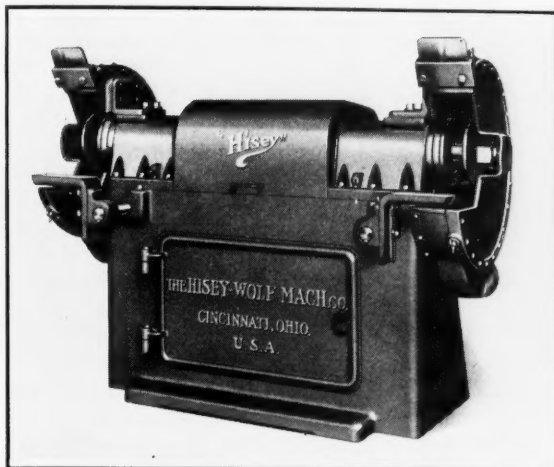
wire sizes, springs having up to twenty-five coils can be wound at the rate of ten per minute. Projecting ends may be left on either or both ends of the spring body, and in some cases, these ends can be formed automatically as they come from the machine. The machine is driven by a motor mounted between the frames. All rotating parts are provided with ball or roller bearings. Nine major adjusting points insure accurate control of spring dimensions. The floor space occupied is 6 by 4 1/2 feet.



Le Blond Heavy-duty Lathe Equipped with Spherical Turning Attachment



Sleeper & Hartley Machine for Winding Torsion Springs at High Speed



Hisey Heavy-duty Snagging Grinder with Independent Speed Controls for the Wheels



Detroit Lead Testing Instrument with Optical and Mechanical Means of Measuring

Hisey Heavy-Duty Snagging Grinder

An independent speed control for each wheel is the principal feature of the heavy-duty snagging grinder here illustrated, which has recently been developed by the Hisey-Wolf Machine Co., Cincinnati, Ohio. This control permits of operating both wheels at the most efficient speeds as they wear down.

This machine is manufactured for 20-, 24-, and 30-inch grinding wheels of both high-speed and vitrified types, spindle speeds being provided to correspond with the spindle sizes. Power is transmitted from the motor to the spindles through V-belts. An automatic belt tension adjustment is furnished. Ball or Timken roller bearings may be furnished for the spindles.

Improved "Fleetweld" Electrode

An improved, heavily coated electrode for welding within a shielded arc on mild steel is being placed on the market by the Lincoln Electric Co., Cleveland, Ohio. Like its predecessor, this electrode will be known commercially as "Fleetweld." It has been developed to insure a higher ductility of the weld metal, 20 to 30 per cent elongation in 2 inches, and an increase

of about 10 per cent in the tensile strength, which averages between 65,000 and 80,000 pounds per square inch.

The resistance to corrosion is greater than that of mild steel. This electrode will be produced in diameters of from 1/8 to 3/8 inch, and in the standard 14-inch and the special 18-inch lengths.

Lead Testing Instrument

An instrument that combines optical and mechanical means of measuring lead has been brought out by the Detroit Tap & Tool Co., 8432 Butler St., Detroit, Mich. Measurements are made by means of a spiral micrometer and a microscope which are supported on a carriage. The microscope focusses on an optical scale which is supported on the bed and is located as near as possible to the work. The carriage is fitted with a spring-loaded

plunger that carries a removable ball point for gaging two adjacent threads of the piece being tested. This plunger mechanically locates the carriage, its position being shown in the microscope. The carriage moves on ball races.

The optical scale can be adjusted longitudinally by means of a screw at the left-hand end of the instrument for making any graduation coincide with the zero line in the ocular for use as a starting point. Light is transmitted through the scale by a mirror on the right-hand end of the base and a second mirror suspended from the carriage below the scale and in the optical axis of the microscope.

The spiral micrometer of the microscopic unit can be read quickly, so that the time required for operating this instrument is reduced to a minimum. It is said that the maximum error will not exceed 0.00004 inch in 1 inch.

Barnes Drill Co.'s Multiple-Cylinder Honing Machine

All the bores in automobile and other gasoline-engine cylinder blocks having four, six, or eight cylinders can be finished simultaneously by honing on the No. 214 multiple-cylinder honing machine recently placed on the market by the Barnes Drill Co., 814 Chestnut St., Rockford, Ill. This machine is of ball-bearing,

self-oiling, all-g geared construction, with hydraulically reciprocated spindles. High output is one of the features, it being claimed that cylinder blocks in which the bores have been reamed uniformly to within 0.0015 to 0.003 inch of the required size can be finished within limits of 0.0005 inch at a pro-

SHOP EQUIPMENT SECTION

duction rate of 100 blocks per hour.

The machine shown in the illustration is equipped with a four-spindle adjustable-type auxiliary honing head, but either fixed or adjustable-center heads can be supplied for blocks with four, six, or eight cylinders. The illustration also shows the machine equipped with a tunnel type of work-holding fixture.

A patented "unitary" lever control simultaneously engages the multiple-disk driving clutch and opens the hydraulic valve to start both the rotation and reciprocation of the hones. The machine is geared for one constant speed of rotation, but the cycles of reciprocation can be changed to suit requirements while the machine is running, by means of the volume control on the Oil-gear pump. A latch on the control lever permits hand control of the vertical spindle movement without engaging the clutch that drives the spindles. Thus the hones can be brought to the work or lifted from it without rota-

tion, as is essential if the hones are collapsed, unless they are of the full-automatic type.

The machine has an electrically controlled automatic counting device, which can be set for any predetermined number of strokes. A greater or lesser number of strokes than that of the setting can be obtained by a push-button control. This counting device is designed for use with automatic-type hones only. The machine can be adjusted for any stroke from 1 to 16 inches.

The Oilgear pump of the hydraulic system for reciprocating the honing head is mounted in the machine column. The hy-

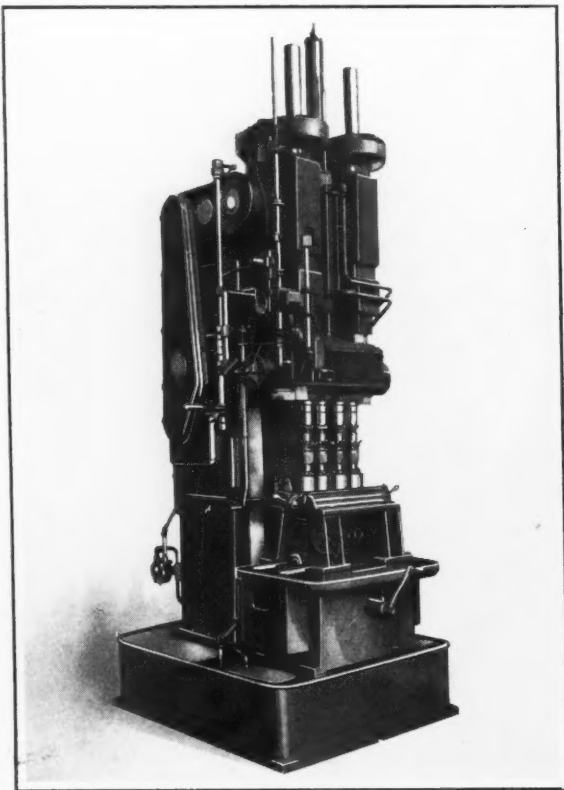
draulic cylinder is mounted between the spindle housings, and the piston is attached to the auxiliary head on the center line of the spindles, midway between them. A filtering system and reservoir for the coolant is built into the column and base. Filtered coolant is delivered to the work under automatic control, the flow of coolant starting when the head is advanced to the honing position and stopping when the head is lifted from the block. A 20-horsepower motor is recommended for honing four-cylinder blocks, and a 25-horsepower motor for six- and eight-cylinder blocks.

French 300-Ton Hydraulic Honing Press

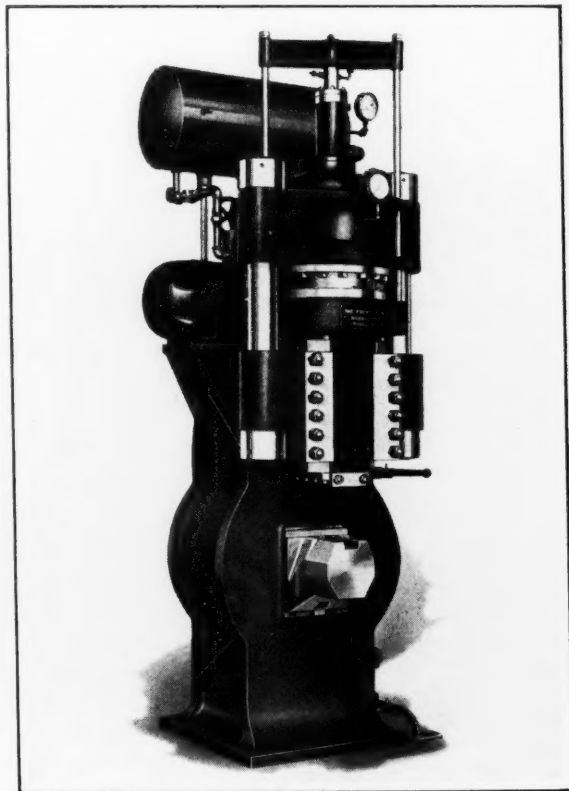
A 300-ton hydraulic honing press that operates continuously at a speed of thirty-five strokes per minute was recently built by the French Oil Mill Machinery Co., Piqua, Ohio, for the Firestone Steel Products Co. The "Hydromatic" unit of this press

can be set to operate at any stroke or pressure. The press can also be set to reverse instantly to the open position when the desired pressure has been reached. The opening is adjusted by a collar on a control rod.

Hydromatic presses are also



Machine Built by the Barnes Drill Co. for Honing All Bores of Cylinder Blocks at One Time



Hydraulic Honing Press of 300 Tons Capacity Built by the French Oil Mill Machinery Co.

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made in the usual column types by this concern, and with the columns enclosed in large housings for guiding the moving platen by means of gibs. Hy-

draulic die cushions for drawing operations may be built into the machines. These presses are made in sizes and capacities to suit any requirement.

Moline Inclined Cylinder Boring Machine

A special boring machine with the spindles inclined was recently built by the Moline Tool Co., Moline, Ill., for rough-boring, finish-boring, reaming, and counterboring eight-, twelve- and sixteen-bore cylinder castings. This machine was supplied to the American LaFrance and Foamite Corporation, Elmira, N. Y. The cylinder castings handled are unusually large, the twelve-cylinder type weighing 568 pounds. The bores are in two rows and inclined at angles.

To permit machining these cylinder blocks with minimum handling, the machine is equipped with a turntable by means of which the blocks can be quickly reloaded into the jig for finishing the second row of bores after the first row has been machined.

Every second hole in either row is machined at one setting, and the casting is then indexed for machining the alternate bores.

Oilgear hydraulic equipment provides an adjustable feed, the entire stroke or travel of the rail being 24 inches. Three spindle speed changes are provided

through pick-off gears—60 feet per minute for the roughing and semi-finishing cuts; 25 feet per minute for the counterboring; and 45 feet per minute for an intermediate speed. The heavy construction of the heads that carry the boring spindles eliminates the necessity of piloting the boring-bars either above or below the work.

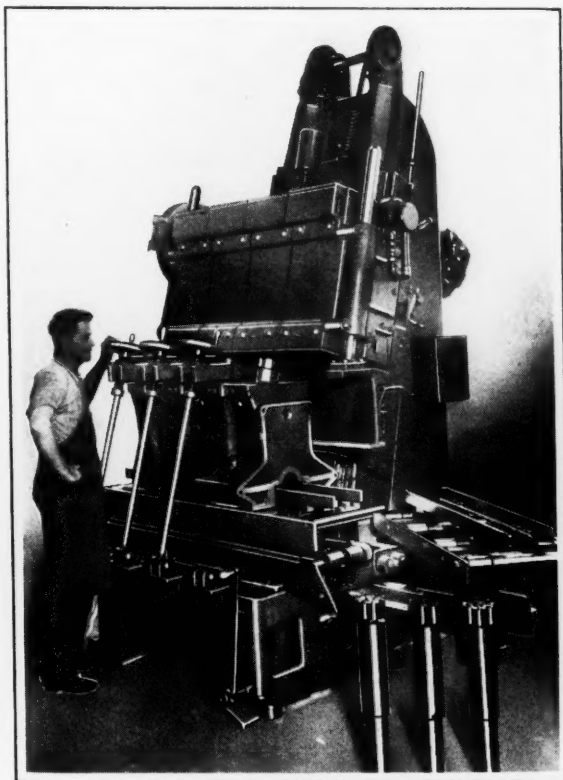
The spindles and the Oilgear unit are driven by a 30-horsepower motor through a silent chain. The weight of the machine is approximately 30,000 pounds, and the over-all height is 10 feet.

Allen Ball-Bearing Drilling Machines

Drilling machines equipped with either a direct motor drive on each spindle or a belt drive to each spindle are being built by the Chas. G. Allen Co., Barre, Mass., in all combinations from one to six spindles. Fig. 1 shows a four-unit motor-spindle drilling machine, and Fig. 2 shows a single-spindle belt-driven ma-

chine. Both machines are shown equipped with a power feed, but a cam feed is also available. A built-in tapping device can be supplied if desired.

On the motor-spindle machines, the motors are of the constant-torque type, and are wound for four speeds in two distinct ranges as follows: 600,



Moline Cylinder Boring Machine for Cylinder Castings with Inclined Bores

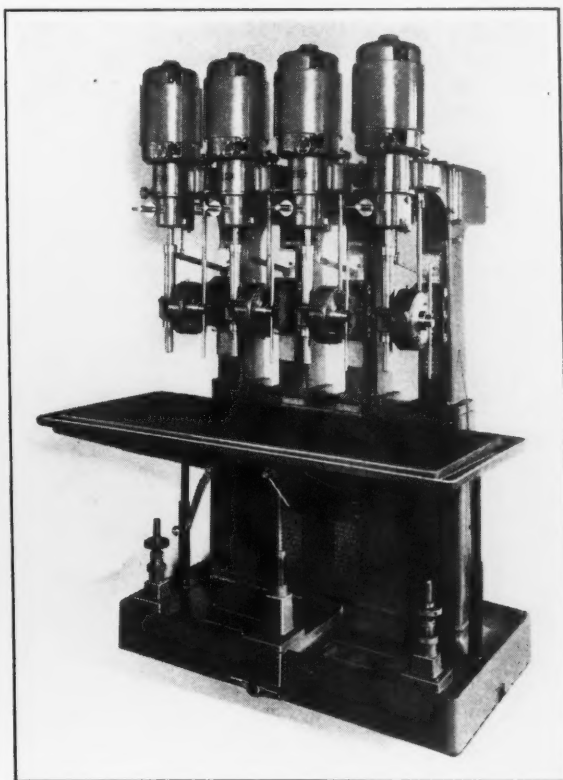


Fig. 1. Allen Drilling Machine with Direct Motor Drive for Each Spindle

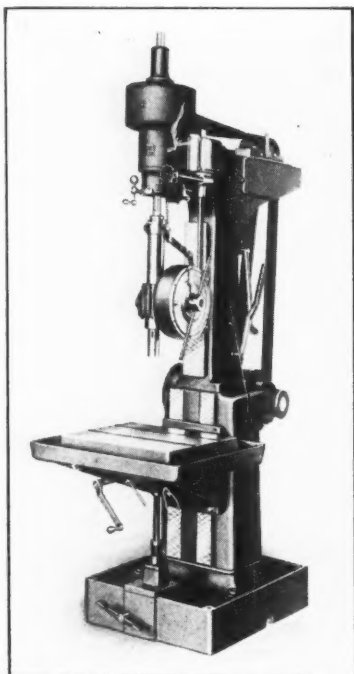


Fig. 2. Single-spindle Belt-driven Machine with Power Feed

1200, 1800, and 3600 revolutions per minute or 600, 900, 1200, and 1800 revolutions per minute. The motors operate on 220-, 440-, or 550-volt, three-phase, 60-cycle alternating current. The controller for changing the motor speeds is mounted in the compartment at the rear of the motor.

In addition to the four open motor speeds, four reduced speeds can be obtained through ball-bearing back-gears of the sliding type. Any reduction ratio up to a maximum of 4 to 1 can be furnished. A dial on the front end of the controller shaft indicates the speed being used,

whether direct or through the back-gears. Shifting of the back-gears, except when the controller is in the "off" position, is prevented by an automatic interlock. Standard equipment includes individual motor protection and an enclosed magnetic switch operated by a foot-treadle for starting and stopping all spindles.

Four spindle speeds are available on the belt-driven machines through a two-step spindle pulley and a two-step back-shaft pulley. Back-gears of the sliding type provide a series of four slower speeds. The speeds are changed instantly through a lever at the front of each top column. The use of ball bearings throughout the drive permits the use of high spindle speeds.

The power feed is applied through worm-gearing. Depressing the hand-lever engages the power feed, and lifting the lever, disengages it. The feed gearing is enclosed in the head under the spindle pulley. Cam feeds can be furnished in several different forms.

Nitr alloy Rotary Pumps

The line of rotary pumps made of Nitr alloy steel, produced by the Northern Pump Co., Minneapolis, Minn., has been expanded by the addition of an XD series. The capacity range of the new series is from 1 to 15 gallons per minute. Two types of bearing construction are available—Nitr alloy bearings for supporting the pump shafts used in pumps intended for handling fuel oil, gas oil, glucose, coolant, and other liquids having little or

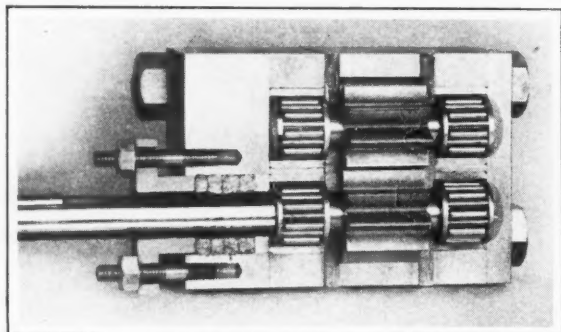
no lubricating value; and roller bearings for pumps intended for handling clean lubricating oil, especially under high pressure conditions such as 1000 pounds per square inch.

Because of the resistance to abrasion of the Nitr alloy parts, it is claimed that these pumps will last indefinitely. They are particularly intended for use on machine tools of all kinds employing hydraulic feed mechanisms, chucks, etc., and for handling coolants. The pumps are also recommended by the manufacturer for hydraulic hoists, lifts, conveyors, presses, bulldozers, cranes, stokers, etc.

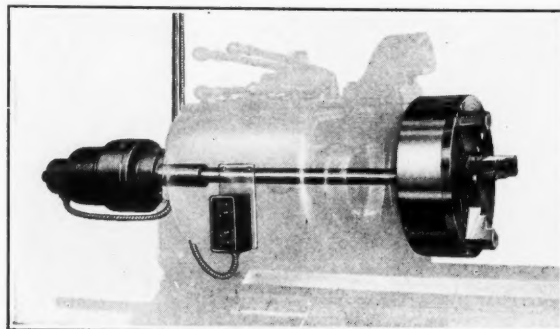
Union Electric Power-Operated Chuck

After a number of years of experimentation, the Union Mfg. Co., New Britain, Conn., has begun the manufacture on a commercial basis, of a line of electric power chucks in sizes of from 6 to 24 inches. The chucks are of the draw-bar type. In the larger sizes, they are operated normally by a 10-foot-pound torque motor, capable of applying a 12,000-pound pressure at the jaws. This jaw pressure can be regulated in four distinct stages, according to the pressure required. In the smaller sizes (6 to 12 inches, inclusive), a 6-foot-pound torque motor is used, with a maximum jaw pressure of 9000 pounds and the same range of pressure regulation.

The operation is simple; the jaws are either opened or closed merely by pushing a button. The



Nitr alloy Rotary Pump for Machine Tool and Other Service



Union Electric Power-operated Chuck Made in 6- to 24-inch Sizes

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jaws cannot be released except by the push-button control. The current is operative only for a few seconds while tightening or releasing the chuck. As the chucking time is approximately only 1 1/2 seconds, the cost of current consumption is said to be less than two cents per day for ordinary production work.

The chuck body is of forged steel, with a one-piece hardened steel face rigidly attached to it. This hardened steel face forms the ways for the master jaws, insuring exceptionally long service. The jaw movement is 3/8 inch for each master jaw. The top jaws can be stepped along the master jaws to the full diameter of the chuck. This makes it unnecessary to have more than a single set of top jaws for practically all operations. The working parts of the chuck are made of heat-treated alloy steel. The chucks are capable of withstanding a draw-bar pull ranging from 20,000 to 40,000 pounds, according to their size. The reducing gear is fitted with large ball thrust bearings and chrome-nickel steel gears, running in light grease. The reducing gear and motor can be adapted to drive any type of power chuck.

Thor Drilling and Honing Machine

The combination drilling and honing machine here illustrated is the latest addition to the Thor line of universal electric tools manufactured by the Independ-

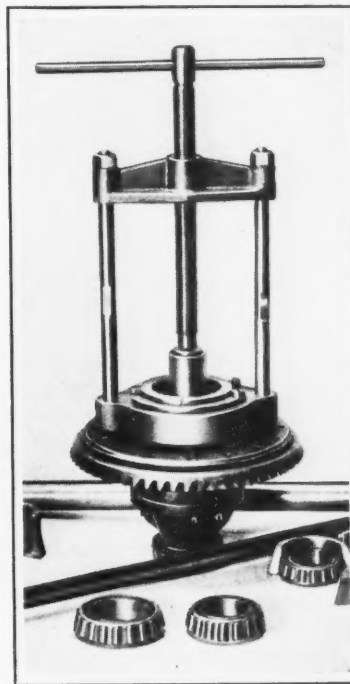
ent Pneumatic Tool Co., 606 W. Jackson Blvd., Chicago, Ill. This machine is equipped with ball bearings throughout and is designed to develop high power and torque. The unusually high speed at which this machine drives the hone gives a very smooth finish.

The drilling capacity is 7/8 inch and the reaming capacity 9/16 inch. The length over all is 18 inches, the spindle is offset 1 13/16 inches, and the weight is 25 3/4 pounds. The machine can be furnished with a 5/8-inch Jacobs chuck for drilling up to 5/8 inch or for driving a cylinder hone, or it can be furnished with a No. 2 Morse taper for drilling up to 7/8 inch.

Universal Dismounting Press

A universal dismounting press which easily removes Timken and other anti-friction bearings from shafts without damaging them has been placed on the market by the Curtiss & Smith Mfg. Corporation, 245-251 South St., Newark, N. J. The device will also disassemble gears, pulleys, collars, bushings, and other parts fitting tightly on a shaft that can be removed either by pushing or pulling.

Chucks, adapters, bases, etc., are provided for dismounting various parts. The chuck or adapter is merely placed on the part to be removed and the unit is attached to the press. Then the press screw is turned to re-

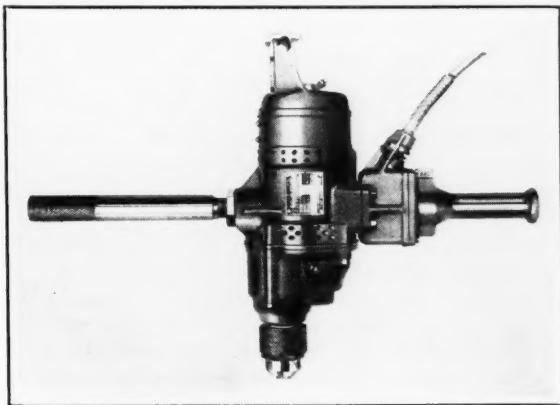


Press Designed for Removing Anti-friction Bearings from Shafts

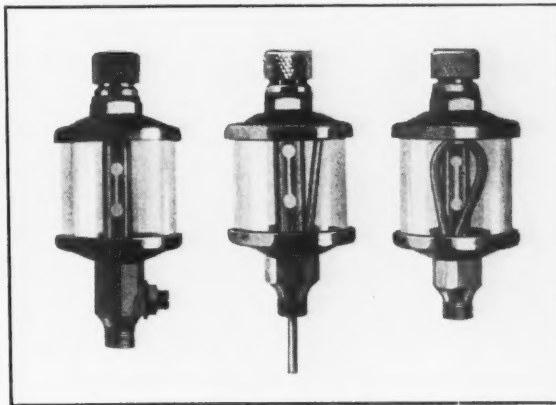
move the part from the shaft. Only a slight pressure is applied to any ball or roller of bearings dismounted by this method.

Victor Automatic Lubricators

The automatic lubricators recently placed on the market by the Victor Lubricator Co., 3900 N. Rockwell St., Chicago, Ill., operate automatically by the expansion and contraction of air caused by temperature changes



Thor Electric Drilling and Honing Machine Equipped with Ball Bearings



Victor Lubricators Operated Automatically by the Oil Film on Shafts

of the oil film on the shaft being lubricated.

The lubricator is of air-tight construction, and after oil has been put in it, the cap should be screwed down tight—air-tight. The lubricator can be filled with oil to only three-quarters of its capacity, an air space being maintained above the oil at all times. The operation is by the expansion and contraction of the air in this space. Any slight increase in the temperature of the oil film around the bearing is transmitted through the lubricator to the air space, causing the air to expand. This expansion creates a pressure on the oil, and automatically forces a certain amount of it into the bearing, which results in decreasing the temperature of the oil film in the bearing. This, in turn, reduces the temperature of the lubricator and of the air, causing the air to contract and automatically stopping the flow of oil. The air supply is automatically replenished, the air being drawn through the base of the lubricator to replace the oil that has been fed out.

The lubricators are made in seven different sizes, and may be used singly or two to a bearing to provide for the lubrication of bearings from 3/4 inch to 6 inches in diameter and up to 12 inches in length. The lubricators of these sizes are also made in three different types—a plain type for feeding oil either vertically or from the side of a bearing; a loose pulley type for mounting on the hub of a rapidly



Fig. 1. Olsen Ductility Testing Machine with Motor Drive

rotating pulley; and a crank-rod or eccentric bearing type which is mounted vertically like the plain type. In the two latter types, the arrangement is such that the effectiveness of lubrication remains the same, no matter how rapid the rotation or oscillation of the bearing and lubricator.

Olsen Testing Machines

Three new machines exhibited by the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., at the National Metal Exposition, recently held at Boston, are shown in the accompanying illustrations. Fig. 1

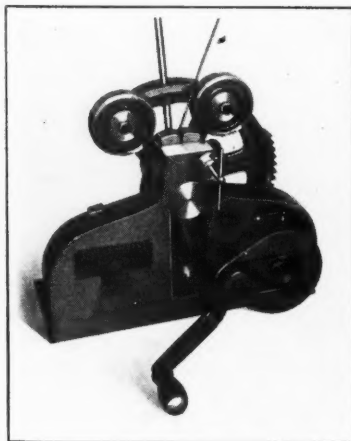


Fig. 2. Warner Reverse-bend Testing Machine

shows a motor-driven ductility testing machine in which the power is applied and the load weighed hydraulically. The cupping tool mechanism is similar in general construction to that employed on other ductility testing machines manufactured by the company.

At all times during the test, the depth of cup and the load being applied are indicated. When the material is inserted and clamped in place, the thickness of the specimen is also shown by a graduated scale under the handwheel.

The depth of cup for the initial load may be made any amount desired by means of an adjustment just beneath the handwheel. When the cupping

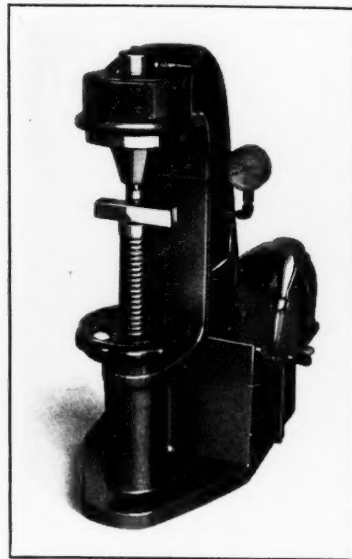


Fig. 3. Motor-driven Production-type Brinell Hardness Tester

tool has produced the depth for which the machine is set, the load is automatically stopped. The load can be read on the large dial at the front of the machine. By simply moving the small lever beneath the handwheel, the load can again be released and it will increase up to the fracture point of the specimen. It is evident that fracture has occurred when the large dial stops its forward motion and starts backward. The dial at the top of the machine indicates the depth of cup under all loads.

Fig. 2 shows a Warner reverse-bend testing machine which can be supplied in various sizes and types, for either hand- or motor-driven operation. The particular machine illustrated is intended for small rods and flat specimens. In the test, the specimen is bent back and forth over definitely shaped jaws. The two large rollers at the top of the machine oscillate back and forth, and travel in a path parallel to the tops of the blocks that grip the specimen.

The motor-driven production-type Brinell testing machine shown in Fig. 3 conforms to the general appearance of other motor-driven Brinell machines built by the concern. This model is unusually silent and fast in operation, and provides for smooth application of the load. Pro-

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vision can be made for operating by means of a foot-treadle. All rotating parts run in oil.

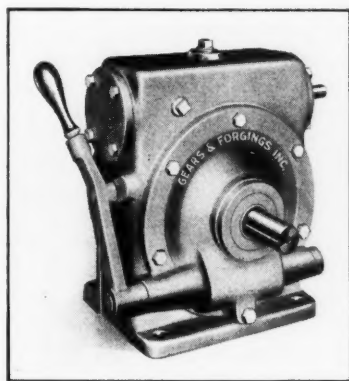
Magnet for Separating Chips from Cutting Oils

A spout-type magnet has recently been produced by the Dings Magnetic Separator Co., Milwaukee, Wis., for separating iron from liquids. This device is particularly designed for use with cutting oils. It consists of an electromagnet of high intensity, which is suspended above the liquid. Prongs dipping into the cutting oil draw the particles of iron to them by magnetism. Periodically the magnet is swung out of the spout and the current turned off to discharge the accumulated iron.

Two-Speed Worm-Gear Reducer

Two speeds are available in a worm-gear reduction unit recently introduced to the trade by Gears & Forgings, Inc., Cleveland, Ohio. These units are designed for either horizontal or vertical drives of 1/8 horsepower and up. The speed reducer can be furnished integral with the motor or as a separate unit, in reduction ratios ranging from 4 to 1 up to 150 to 1.

The unit consists of a worm and worm-gear and a set of differential gears. The driving shafts and the Timken roller bearings in which they are



Worm-gear Speed Reducer with Two Speeds

mounted are enclosed in leak-proof and dustproof housings. The two speeds are obtained by means of the differential gearing. The high speed is secured by moving the small hand-lever to the right. This locks the differential to the low-speed shaft, and the worm-gear and differential gearing then rotate as one unit. Movement of the hand-lever to the left locks the side gear of the differential and prevents it from rotating. Then one-half of the revolutions of the worm-gear are imparted to the slow-speed shaft. A change in the output speed can be made while the unit is in operation under full load.

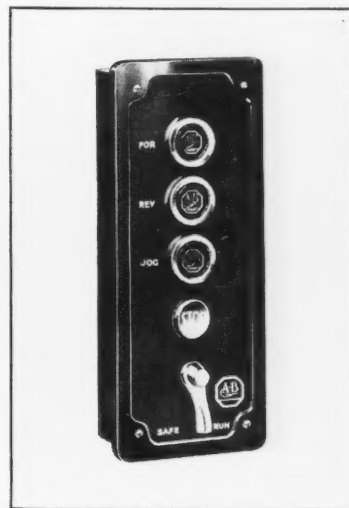


Binghamton Flexible-shaft Grinder of Improved Design

Binghamton Portable Flexible-Shaft Grinders

A line of portable electric grinders of an improved design is being placed on the market by the Binghamton Flexible Shaft Co., Maple Ave., Johnson City, N. Y. This line includes both single- and three-speed machines, provided with the tilting and swiveling feature of the motor unit shown in the illustration. Long life of the flexible shaft is claimed for this feature.

Grooved pulleys and V-belts are employed on the four-speed drives. The motor is totally enclosed and is of the full ball-bearing type. The hand-piece and countershaft are also equipped with ball bearings.



Allen-Bradley Four-button Motor Control Station

Four- and Five-Button Motor Control Stations

Four- and five-button stations have recently been added to the line of push-button controls made by the Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. The four-button stations have three buttons that give a like number of motor speeds, and one button for stopping. The buttons can also be arranged for forward, reverse, and jogging motions, as well as for stopping. The five-button stations are intended for use with four-speed motors.

Cutler-Hammer Across-The-Line Manual Starter

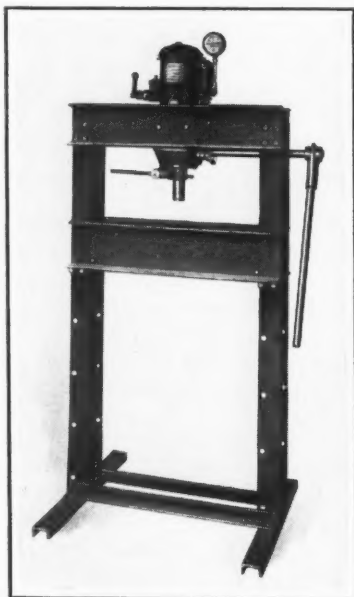
Three- and four-pole types, across-the-line, X manual starters, designated as Bulletin 9115, which are made by Cutler-Hammer, Inc., 1295 St. Paul Ave., Milwaukee, Wis., have been redesigned to incorporate thermal overload relays in place of the thermal overload cut-outs formerly supplied. The overload relay provides many features that were not obtainable with the thermal cut-out. For instance, should an overload occur which may be dangerous to the motor, the overload relay will trip and open two lines to the motor, so that the entire circuit

is opened and the motor cannot run.

After the motor has been tripped, the operating handle is merely returned to the full "off" position to reset the overload relay. The motor can then be started again. This feature eliminates the time required for renewing the fusible clips of the old cut-out.

Hannifin-Vickers Hydraulic Presses

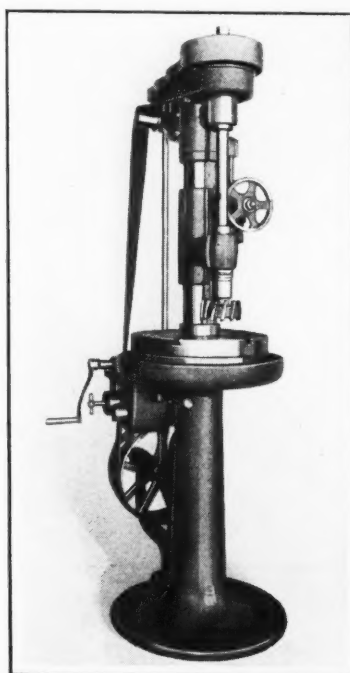
A new line of general utility presses is being placed on the market by the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill., in hand-operated and motor-driven types, and in capacities of 20, 40, and 60 tons. The entire operating mechanism of these presses, including the cylinder, pump, valves, and reservoir, comprises an integral unit. The hand-operated machine illustrated can be easily converted into the motor-driven type, in which case the motor is mounted on top of the frame for driving the shaft on which the operating handle is seen. All frames are constructed to receive the motor drive. The self-contained hydraulic unit is also available without the frame.



Hannifin-Vickers Hand-operated Press with Self-contained Hydraulic Unit

Bemis Continuous Milling Machine

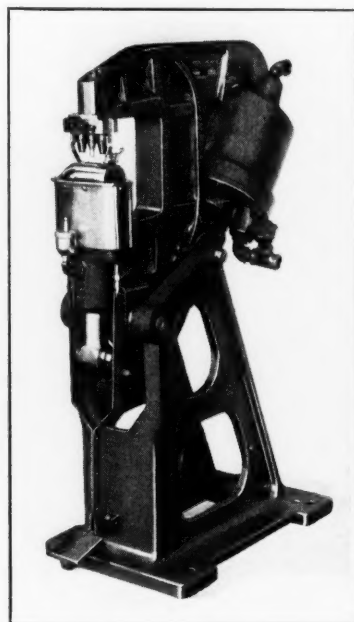
A continuous milling machine of small size is being placed on the market by the E. W. Bemis Machine Co., 92 West St., Worcester, Mass., for performing milling operations on small pieces. This machine stands six feet above the floor and is driven from a countershaft. The worktable is 17 1/2 inches in diameter and revolves around a post on balls 1/2 inch in diameter. The table is driven by worm-



Bemis Continuous Milling Machine for Small Parts

gearing, four different speeds being obtained through a gear-box.

The spindle carries a 5-inch milling cutter, has two speeds, and runs in a tapered bronze bearing. The greatest distance from the cutter to the table is 5 7/8 inches. After the table is loaded and the milling operation begun, the operator removes the finished pieces as soon as they pass the cutter and replaces them with new pieces while the table continues to revolve. The machine can be furnished with bronze bearings in a belt-driven type or with ball and roller bearings in a motor-driven type.



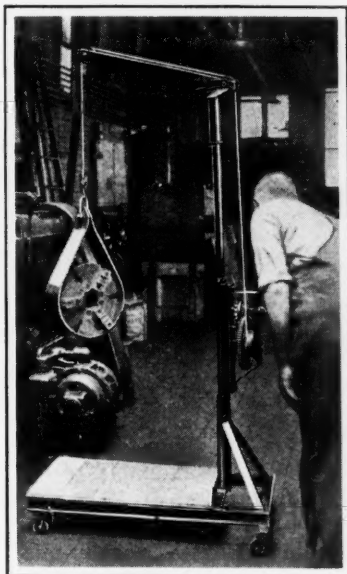
Hanna Riveter for Assembling Parts Held in a Fixture

Hanna Riveter with Assembling Fixture

A riveting machine designed primarily for assembling parts difficult to fit and hold together by hand while being riveted, has recently been developed by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill. The parts to be riveted may be placed in the machine progressively and then clamped quickly by power. In the particular application illustrated, the casing and two handle brackets of an electric flat iron are being riveted together. Each bracket is joined to the casing with but one rivet. The fixture supports, locates, and clamps the parts until the rivets are driven.

Both rivets are driven simultaneously. The upper dies that engage the preformed rivet heads float laterally a sufficient amount to compensate for the eccentricity frequently existing between the preformed head and the rivet shank. The fixture is opened by foot, and the riveter-operating valve is also foot-actuated. With this arrangement, the operator's hands are free to load and unload the fixture. The riveter pressure is equally divided between the two sets of dies.

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Hoist for Lifting Machine Chucks into Position

Economy Hand-Operated Chuck Hoist

The hand-operated hoist here illustrated has been brought out by the Economy Engineering Co., 2635 W. Van Buren St., Chicago, Ill., to provide a convenient means of handling machine chucks without the danger usually involved. The device is light and easily moved around.

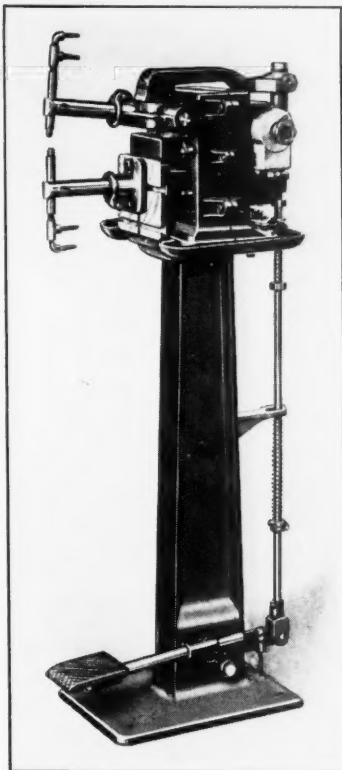
The rear wheels are mounted on swivels, while the ones at the front are fixed. The top of the boom is 6 feet 4 inches above the floor, enabling the chuck to be raised high enough for any ordinary lathe. The saddle for the chuck is 6 inches in width and large enough to accommodate chucks weighing up to 200 pounds. The end of the boom can be moved to a point about 6 inches from the center line of the machine on each side to facilitate locating the chuck for attaching it to the spindle. A ratchet and friction disk arrangement automatically holds the load wherever desired.

Eisler Electric Spot-Welding Machines

The Eisler Electric Corporation, 740-772 S. Thirteenth St., Newark, N. J., has expanded its

line of "Speed" spot welders so that it now includes machines with capacities of 1/2, 1, 3, 5, 10, 20, and 35 kilovolt-amperes. These machines are capable of handling combined thicknesses of steel from 0.0005 to 5/8 inch. They may be equipped for foot- or motor-driven operation.

These welding machines are suitable for use in the manufacture of radio tubes, incandescent lamps, automotive and electrical appliances, metal novelties, jewelry, and sheet-metal parts. They



"Speed" Spot Welder Made by the Eisler Electric Corporation

will weld aluminum, Ascoloy, brass, copper, galvanized iron, lead, Monel, nickel, Nichrome, tin plate, zinc, phosphor-bronze, nickel-silver and other metals.

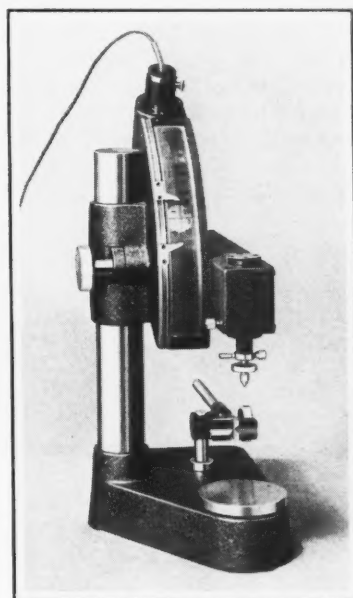
Zeiss "Optotest" Indicating Gage

An indicating limit gage known as the "Optotest," designed to combine high gaging speed with ease and accuracy of reading, has been added to the line of Zeiss instruments handled

by the George Scherr Co., 128 Lafayette St., New York City. The operating principle of the Optotest is that of translating the movement of a contact plunger into a corresponding tilting of a mirror, which reflects the image of a brightly lighted mark on a large stationary scale graduated to 0.0001 and 0.00005 inch. The zero setting of the instrument can be made quickly from a sample, gage-block, or master part.

Errors in the work are indicated directly within limits defined by conspicuous tolerance marks. An error of one ten-thousandth inch on the work produces a movement of nearly one-eighth inch on the scale. The instrument is designed to maintain a constant gaging or measuring pressure on the work so that an unskilled operator can perform the gaging operations at high speed.

Provision is made for an adjustable back-stop to locate the work positively while measuring. The back-stop of the instrument illustrated has two V-channels which are positioned at right angles to each other for locating spherical-end standards and similar parts. A special attachment is provided for gaging wire by allowing it to run continuously underneath the contact plunger.



"Optotest" Limit Indicating Gage for Rapid Inspection

National "Helex" Taper-Pin Reamers

Taper-pin reamers designed with a steep spiral angle to promote smooth cutting and eliminate chatter have been placed on the market under the trade name of "Helex" by the National Twist Drill & Tool Co., Detroit, Mich. The cutting edges are under-cut and have a left-hand spiral, thus giving a shear-cut action without any tendency to "hog in." The chip spaces are ample to obviate clogging in the flutes.

These taper-pin reamers are furnished in both carbon and high-speed steel for operation at or near drilling speeds. The sizes range from 0.057 inch to 1.249 inches in diameter at the small end, while the length of the flute ranges from 1 to 14 inches.

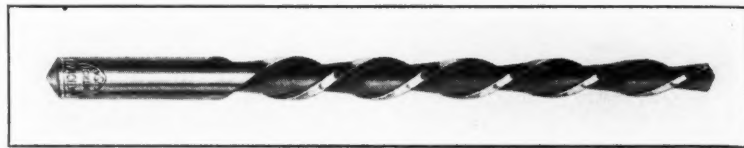
Brown & Sharpe Pressure Relief Valve

A pressure relief valve for hydraulically operated machinery has recently been added to the line of pumps and accessories made by the Brown & Sharpe Mfg. Co., Providence, R. I. This valve is particularly adapted for use with hydraulic mechanisms and with the Nos. 53 and 55 rotary geared pumps made by this company.

By removing the hexagon cap on the relief valve and turning the adjusting screw, the compression on the valve springs may be adjusted so that the valve

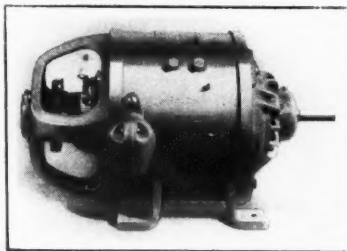


Brown & Sharpe Relief Valve for Hydraulic Equipment



"Helex" Taper-pin Reamer Made in Both Carbon and High-speed Steel

will operate at any desired pressure from 0 to 200 pounds per square inch. Guides on the valve prevent "fluttering" and noisy operation. The large valve chamber permits a ready escape for the by-passed liquid, and the double spring arrangement gives a wide range of adjustment and flexibility. This valve is made for 1-inch piping.



Reliance Direct-current Motor
Built in Sizes of from
1/2 to 3 Horsepower

Reliance Direct-Current Motors

A line of direct-current motors in sizes of from 1/2 to 3 horsepower, running at 1750 revolutions per minute, for constant- or adjustable-speed operation, has been added to the products of the Reliance Electric & Engineering Co., 1042 Ivanhoe Road, Cleveland, Ohio. These motors are provided with either ball or sleeve bearings, and may be had in open, semi-closed, or fully enclosed construction.

The windings are finished with a coat of bright orange-colored enamel which facilitates the detection and removal of dirt. The commutators are of the refillable type, and if the copper bars become damaged or badly worn, they can be easily replaced. Two brushes are provided for each stud to insure efficient operation with a minimum of attention.

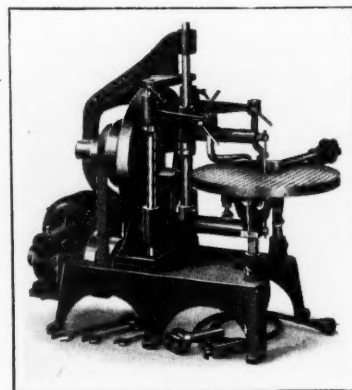
"Promal" for Industrial Castings

"Promal" is a metal originally developed by the Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., for making conveying and power transmission chains. This metal is now available to other manufacturers. It is a special processed malleable iron that has a radically different microstructure and physical properties from ordinary malleable iron. It can be heated repeatedly to a maximum of 1000 degrees F. and cooled without affecting the physical properties. This characteristic makes the metal suitable for low-temperature heat-treating equipment and parts that are to be hot-dip galvanized.

Other physical properties are: Yield point, 50,000 pounds per square inch; ultimate strength, 70,000 pounds per square inch; fatigue strength, 33,000 pounds per square inch; elongation, 10 to 14 per cent in 2 inches; modulus of elasticity, 26,000,000; and Brinell hardness, 170 to 190.

Wittek Die Sawing and Filing Machine

A universal die sawing and filing machine designed for use



Wittek Universal Sawing and Filing Machine

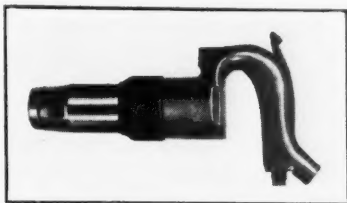
SHOP EQUIPMENT SECTION

in making dies, punches, templates, gages, and other irregular shapes has just been placed on the market by the Wittek Mfg. Co., 4305 W. 24th Place, Chicago, Ill. The machine is suitable for machining metal, fiber, Bakelite, and similar materials. The illustration shows a bench model equipped with a motor drive, but the machine is also furnished in belt-driven types and in floor models.

The machine illustrated has a stroke adjustable from 1 3/4 to 5 1/4 inches. Three speeds of approximately 75, 150, and 300 strokes per minute are available. The upper arm holder for the saw or file is adjustable vertically to permit using tools up to 10 inches long. In using short files, this holder is swung clear of the table and the saw is gripped only by the lower holder. Adjustable hold-downs are provided, which can also be swung out of the way when not required. The table is adjustable to any angle in any direction. It is also adjustable up and down. Two adjustable roller guides, one above and one below the table, guide the saw.

Hercules Pneumatic Chipping and Riveting Tool

The Hercules pneumatic high-speed chipping and light-riveting hammer here illustrated is being placed on the market by the Buckeye Portable Tool Co., Dayton, Ohio. The outstanding feature of this hammer is a "one-diameter" piston, which is self-controlled and the only moving part. There are no valves or flapper plates, the piston



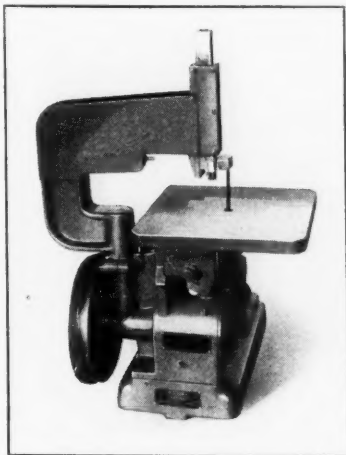
Hercules Pneumatic Riveter with but Three Major Parts

itself serving as both valve and piston. The piston is balanced to eliminate friction on the cylinder walls.

The tool is designed to operate without recoil or vibration, and it can be throttled down for light blows without jumping or stopping. There are only three major parts—the handle, cylinder, and piston.

Oliver Diemaking Machine

A redesigned diemaking machine with improvements that



Oliver Diemaking Machine for Filing, Sawing, and Lapping Operations

increase its efficiency and facilitate its operation is being introduced to the trade by the Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich. The Type S-4 machine illustrated is driven by a motor and belt, and is arranged for bench mounting. However, direct motor-driven, belt-driven, and pedestal types can also be furnished.

The table of the new machine is of heavier construction than previous models and is rigidly supported on two brackets. It can be tilted in four directions, and its working surface is accurately ground. A new type of chuck is provided, which consists primarily of a solid jaw and a movable hardened jaw, which are brought together by a screw. The chuck on the lower ram and the one on the upper ram are accurately aligned. The same chucks are used for holding saws, files, and lapping sticks.

The over-arm is used for both filing and sawing. The upper ram is actuated by a bell-crank lever and a heavy coil spring which provides the proper tension on the saw. The over-arm can be swung away from the file to permit the die to be removed for inspection, and brought back instantly to the same position for resuming the filing operation. With this arrangement, it is not necessary to remove the file or loosen it from the lower clamp in order to inspect the die.

This over-arm eliminates the need for hold-down brackets, fingers, or file rollers, which were required with previous models. The hold-down fingers are now attached directly to the over-arm, thus leaving the working surface of the table clear.

"Leadhesion" Coating Process

A method of applying a permanently adhering lead coating of any desired thickness to metal surfaces as a protection against corrosion has been developed by the Gross Engineering Corporation, Cleveland, Ohio. This is known as the "Leadhesion" pro-

cess. The fact that this process is as easily employed in the installation of large and small work in the field as it is in regular shop work makes it particularly applicable to the wide range of tanks, vacuum and pressure vessels, and moving parts of acid- or brine-proofed machinery in which this company specializes, as most of this

equipment has to be coated in position.

The process is suitable for use in chemical, paper-making, oil-refining, and other industrial plants handling corrosive materials or fumes, or for any service where especially difficult conditions are to be met. It was invented by Louis Gross, president of the corporation.

Detecting Defects in Metals with Radium

In a recent issue of *Research Narratives*, published by the Engineering Foundation, 29 W. 39th St., New York City, we are told that gamma rays from radium can be made to shine through steel objects 12 inches thick and reveal their internal defects. Valves for high-pressure power plants and pipe lines can be inspected by this means. Battleship parts, such as the sternposts and keel knuckles, can be tested before the trial run is made. Welded parts can also be inspected by this means to be sure the welds are sound.

This method of testing reminds one, of course, of the use of X-rays for the same purpose, but it is simpler in some respects, although requiring special procedures in other respects. It is surprising that these gamma rays, known in general for nearly thirty years, should never before have been adapted to make them serve this useful purpose. Those dealing with radium in the past have been either "pure" scientists, interested only in understanding the nature of matter and energy, or they have been biologists, interested in the therapeutic effects of radium on living organisms.

It remained for a mind trained in the science and art of metallurgy, but working in daily contact with research physicists and their theories of waves and of quanta, to evolve a method for the practical use of gamma rays in inspecting metal objects. These favorable con-

ditions existed at the Naval Research Laboratory in Washington, and there a program for developing the gamma ray method was evolved. Nearby, Baltimore had, at the Howard A. Kelly Hospital, a supply of radium. The hospital officials were willing to lend their radium to the Navy Department for the purpose in mind. Another metallurgist was called in, from Lehigh University, to take charge of the experimental program and carry it out.

Many discouraging prophecies were heard as the plans succeeded. Radium experts in New York City assured the projectors that 5 inches of steel would stop all radiation. The literature likewise, although it described attempts at radiography of the human body by gamma rays, concluded that the results were not satisfactory. The rays would be too short in wave-length to affect a photographic film, at least those rays that had penetrating power; the rays would give no sharp definition on the film, no detail; they would be blurred by the "scattering" of rays from surrounding objects; the danger in handling the radium would be too great; the cost would be prohibitive. These and many other objections were advanced, but the work went on.

The principal experimental campaign was concluded in November, 1929. Its success was beyond the highest hopes of those interested in the development

of the investigation. Clear-cut shadows of defects in the interior of steel objects 8, 10, and even 12 inches thick had been registered on the film. Tiny flaws, only 2 per cent of the thickness of the whole object had been clearly revealed.

Practical advantages of the method for examining metal structures was at once obvious. The tiny capsule of radioactive material was so easily transported that it could be carried anywhere—into a submarine, up to the top of a skyscraper, into the machine shop or foundry—anywhere that a large object needed examination. It is not anchored to a laboratory in any way.

Films were simply pasted on the back of an object and the radium mounted in front of it for the exposure. Of course suitable films and screens had to be used to get the proper result. Later the film is removed and developed to show the shadows cast by the object in the path of the rays. A thousand small objects could be exposed at once by simply placing them in a spherical distribution about the radio-active source.

No large investment in testing machinery that was likely to become obsolete in ten years or less was necessary, because radium, the only costly investment, does not decay to half its strength for 1600 years! The cost of the testing operation was well within reason, if radium could be procured at a fair figure. No risk whatever to the operator was in evidence.

Associated Machine Tool Dealers Meet in Chicago

The Associated Machine Tool Dealers met for their regular semi-annual meeting at the Olympia Fields Country Club, Chicago, October 14 to 16. At a dinner on the evening of October 14, the dealers were hosts to the members of the National Machine Tool Builders' Association, at which E. P. Essley, president of the dealers' organization, presided. Assistant Secretary of Commerce, Julius Klein, was the principal speaker. He dealt with the relation of the machine tool industry to some of the outstanding present-day industrial and business problems. Dr. A. D. Albert, director of plans and program of the Chicago World's Fair in 1933, described the principal features of the exposition.

During the meeting, a number of papers were read on the subject of marketing and sales analysis, time-payment financing, and other subjects of importance in the sale of machine tools.

Officers for the coming year were elected as follows: President, William K. Stamets, of the William K. Stamets Co., Pittsburgh, Pa.; vice-president, Herbert E. Oatis, of the National Supply Co., Toledo, Ohio; secretary, Harry Barney, of the Barney Machinery Co., Pittsburgh, Pa.

The following directors were also elected: H. A. Smith, of the H. A. Smith

Machinery Co., Syracuse, N. Y.; L. H. Swind, of the Swind Machinery Co., Philadelphia, Pa.; and John Sauer, Jr., of the Peninsular Machinery Co., Detroit, Mich.

* * *

Dr. Pupin Receives John Fritz Medal

The John Fritz Gold Medal, the highest honor that American engineering societies can bestow upon a fellow engineer, has been awarded to Dr. Michael I. Pupin of Columbia University for his achievements as scientist, engineer, author, and inventor. The award was made by a board representing the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Mining and Metallurgical Engineers, and the American Institute of Electrical Engineers. Dr. Pupin is a past-president of both the American Institute of Electrical Engineers and the American Association for the Advancement of Science. He has been the recipient of many other honors, including the Edison Medal of the American Institute of Electrical Engineers and the Carson Gold Medal of the Franklin Institute.

Meeting of the Gray Iron Institute

The fourth annual meeting of the Gray Iron Institute was held at West Baden, Ind., October 15 and 16. At this meeting, the members of the Institute endorsed a resolution advocating an industrial stabilizing plan in which trade associations would play an important part. Briefly, the Institute expressed itself in favor of some plan similar to the plans recently recommended by the United States Chamber of Commerce, and by Gerard Swope and Owen D. Young. The resolution states that any measures for the stabilization of any industry "should not be dictated by any government department, but should be self-imposed by the industry itself acting through its trade association."

During the two days meeting, several sessions featuring cost, merchandizing, and technical problems were held. The business outlook was also discussed.

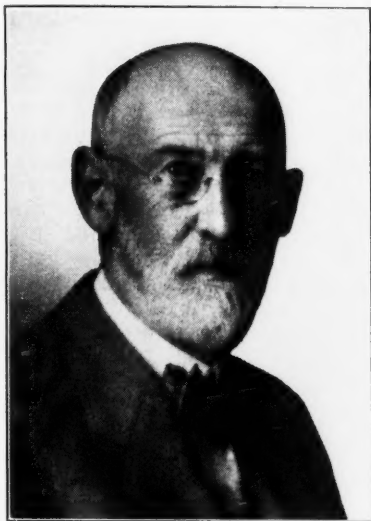
A. E. Hageboeck of the Frank Foundries Corporation, Moline, Ill., was elected president for the coming year; J. L. Carter of the Sacks-Barlow Foundries, Inc., Newark, N. J., was elected first vice-president; and J. H. Bruce of the Bowler Foundry Co., Cleveland, Ohio, second vice-president. A. J. Tuscany, Cleveland, Ohio, is manager of the Institute.

Personals

GEORGE H. MALONY has been elected secretary of Whitman & Barnes, Inc., Detroit, Mich., manufacturer of high-speed twist drills, to succeed J. I. HOLTON, who has resigned.

FRED W. HAMMER, formerly connected with the Philadelphia office of the Warner & Swasey Co., has joined the sales organization of the Swind Machinery Co., Philadelphia, Pa., as sales engineer.

W. A. VIALI, vice-president of the Brown & Sharpe Mfg. Co., Providence, R. I., celebrated his seventieth birthday on October 26. An informal dinner was given in his honor by his immediate



W. A. Viall

associates in the company and a few of his personal friends. Mr. Viall, who has been with the Brown & Sharpe Mfg. Co. for more than forty years, is one of the best known men in the machine tool industry. In this connection it is of interest to record that Mr. Viall's father, R. Viall, was superintendent of the Brown & Sharpe Mfg. Co. for a great many years, being in charge of all factory activities and an associate of Lucian Sharpe, the founder of the company, and that Mr. Viall's son, R. Viall, is also connected with the company as assistant secretary.

A. H. d'ARCAMBAL, of the Pratt & Whitney Co., Hartford, Conn., has been nominated for president of the American Society for Steel Treating for 1932. Mr. d'Arcambal has been a vice-president of the Society during the past year.

GEORGE H. CORLISS, who for the last fifteen years has been advertising manager of the S. A. Woods Machine Co., Boston, Mass., has been appointed advertising and sales promotion manager of the J. A. Fay & Egan Co., Cincinnati, Ohio.

E. R. DOUGHERTY has joined the sales organization of the American Manganese

Steel Co., Inc., Chicago Heights, Ill., and will work with E. F. Mitchell, district manager, in the engineering and sale of Fahlralloy castings in Chicago and the surrounding territory.

HARRY L. ERLICHER, who entered the employ of the General Electric Co., Schenectady, N. Y., as an office boy in the purchasing department, has been appointed purchasing agent, succeeding L. G. BANKER, who retired the first of October, after forty-three years of continuous service.

ROSCOE SEYBOLD has been appointed comptroller of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Seybold has been in the continued service of the Westinghouse company for the last twenty-four years. He is a graduate of Purdue University, and since 1926 has been assistant to the president of the Westinghouse company.

MORRIS SLEPKOW, for thirty-four years in the employ of the Diamond Machine Co., Providence, R. I., is now associated with the selling force of the Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn. FRANK E. BARTLEY, who was connected for a number of years with the Blanchard Machine Co., Cambridge, Mass., has also joined the sales force.

FRANK L. EIDMANN, professor of mechanical engineering, Columbia University, has been appointed director of the Research and Experimental Laboratory of the General Time Instruments Corporation, which is the holding company of the Western Clock Co., the Seth Thomas Clock Co., the Sterling Clock Co., and the Hamilton-Sangamo Co. Professor Eidmann will retain his connection with the university.

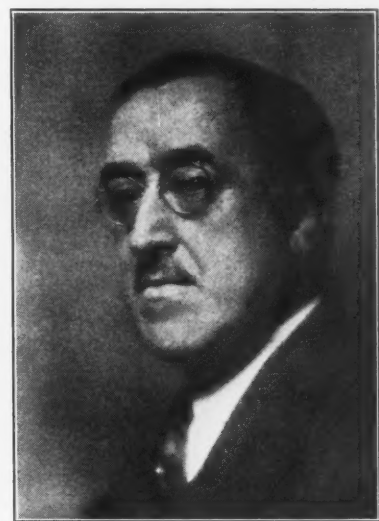
DR. GEORGE B. KARELITZ, formerly manager of the Mechanics Division of the Westinghouse Research Laboratory in East Pittsburgh, has been appointed division engineer in charge of transportation at the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. His duties will include supervision of the manufacture of marine apparatus, Diesel oil engines, and other equipment. R. E. PETERSON, research engineer, will succeed Dr. Karelitz as manager of the Mechanics Division of the Research Laboratory.

LAMONTE J. BELNAP, formerly president of the Worthington Pump & Machinery Corporation, 2 Park Ave., New York City, has been made chairman of the executive committee. As chairman of this committee, Mr. Belnap will maintain his active part in directing the manufacturing, sales, and financial activities of the Worthington Corporation. Mr. Belnap will be succeeded as president by HARRY C. BEAVER, formerly vice-president, who has been associated with Mr. Belnap in various enterprises for the last twenty-five years.

L. P. ALFORD, vice-president of the Ronald Press Co., New York City, and

the author of many books and treatises on management, has been awarded the H. L. Gantt Memorial Medal by the Gantt Medal Board, which consists of representatives of the American Society of Mechanical Engineers and the Institute of Management of the American Management Association. The medal is given annually in recognition of outstanding accomplishments in management engineering. It was presented to Mr. Alford at a special dinner held in his honor at the Hotel Pennsylvania, New York, October 29.

F. J. GRIFFITHS has joined the Timken organization at Canton, Ohio. He has been elected director and president of the Timken Steel & Tube Co. M. T. LOTHROP, president of the Timken Roll-



F. J. Griffiths

er Bearing Co., has been made chairman of the board of the Timken Steel & Tube Co. Mr. Griffiths has been identified with the steel industry for thirty years. Until recently he was associated with the Republic Steel Corporation in the capacity of president of the Republic Research Corporation.

Obituary

FREDERICK J. SMITH, an outstanding figure in the tap and die industry, died at his home in Mansfield, Mass., October 10, aged seventy-five years. Mr. Smith entered the employ of the S. W. Card Mfg. Co., of Mansfield, in 1878, as a toolmaker, and became its president in 1899. In 1909, he was elected president and treasurer of the corporation and retained these offices until 1913, when he sold his interests and retired. In 1914, he acquired an interest in Winter Bros. Co., of Wrentham, Mass., and was elected treasurer of that company, which office he held until 1926, when failing health caused him to relinquish the office. He retained directorship in the company until 1928, when continued poor health caused him to retire from active business.

News of the Industry

AMERICAN MANGANESE STEEL CO., Chicago Heights, Ill., has removed its Chicago office from 333 N. Michigan Ave., to Room 1414, McCormick Bldg., 332 S. Michigan Ave.

PENN ELECTRIC SWITCH CO., Des Moines, Iowa, announces the opening of a sales office in Philadelphia at 2401 Chestnut St. R. V. Clark is manager of the Philadelphia office.

CHICAGO PNEUMATIC TOOL CO., 6 E. 44th St., New York City, has removed its office and service station at Seattle, Wash., from 1743 First Ave., South, to 3201 First Ave., South. C. Kirk Hillman has been appointed district manager.

FOOTE BROS. GEAR & MACHINE CO., 215 N. Curtis St., Chicago, Ill., has appointed L. W. Erickson to succeed E. L. Parsons as district representative for IXL gears and speed reducers in the Milwaukee and Wisconsin territory.

J. L. LUCAS & SON, INC., Bridgeport, Conn., rebuilders of all the well-known types of machine tools, have established an export department at 44 Whitehall St., New York City. The department will be under the direction of Pablo Homs, Inc., export managers.

UNION CHAIN & MFG. CO., Sandusky, Ohio, has appointed C. H. Upson, 1012 Traction Bldg., Cincinnati, Ohio, representative of the company in that territory. Mr. Upson has had wide experience in the field of power transmission, elevating, and conveying.

SHEPARD NILES CRANE & HOIST CORPORATION, Montour Falls, N. Y., announces that the Chicago office of the company has been removed from the People's Gas Bldg. to 564 W. Monroe St. Walter B. Briggs is district manager, and associated with him is G. G. Robbins.

DOEHLER DIE CASTING CO., 386 Fourth Ave., New York City, announces an arrangement with the BOHN ALUMINUM & BRONZE CORPORATION by which the Doehler Die Casting Co. takes over the Bohn Die Casting Division in exchange for the Doehler permanent mold department.

BUNTING BRASS & BRONZE CO., Toledo, Ohio, announces the opening of a new branch sales office and warehouse at 1250 Ontario St., Cleveland, Ohio. The new branch will carry a complete stock of Bunting "Ready Made" bronze bushing bearings, cored and solid bronze bars, babbit, and copper-bronze and lead hammers.

INDEPENDENT PNEUMATIC TOOL CO., 606 W. Jackson Blvd., Chicago, Ill., has moved its Birmingham, Ala., office from the Comer Building to 915 N. 7th Ave. The new location has warehouse facilities which will enable the Birmingham office to carry a complete line of pneumatic and electric tools, as well as spare parts. H. F. Halbert is manager.

NATIONAL TOOL CO., Cleveland, Ohio, announces that the United States Circuit Court of Appeals, Sixth Circuit, has affirmed the decision of the United States District Court for the Northern District of Ohio, Eastern Division, in favor of the National Tool Co., in the matter of alleged infringement by this company of certain gear-grinding machine patents owned by the Lees-Bradner Co.

DARDELET THREADLOCK CORPORATION, 120 Broadway, New York City, has licensed the Rockford Screw Products Co., Rockford, Ill., to manufacture and sell bolts, nuts, and screws threaded with the Dardelet self-locking thread. Manufacturing and selling licenses for this thread have also been granted recently to William Gaskell & Son, Brooklyn, N. Y., the Harrison Bolt & Nut Co., Harrison, N. J., and the Standard Pressed Steel Co., Jenkintown, Pa.

METAL PRODUCTS ENGINEERING CORPORATION, 341 Water St., New York City, has been organized by Nicholas Manoilovich, formerly of the M. Nicholas Tool & Machine Works, and Eugene Gruen, formerly of the Automotive Specialty Corporation. The new corporation will manufacture screw machine products, dies, and tools, and do general contract manufacturing. Mr. Manoilovich is president and treasurer, and Mr. Gruen is vice-president and general manager.

LINCOLN ELECTRIC CO., Cleveland, Ohio, manufacturer of "Stable-Arc" welding equipment and "Linc-Weld" motors, has been appointed general industrial distributor for "Blackor." This is a black, granular material of tungsten carbide which is applied as a resistant facing to tools subject to abrasive wear. It eliminates the need for insert metals, as the hard facing supplied by Blackor performs the work of an insert. Blackor, applied with a carbon arc, covers the entire abrasion surface of a tool.

LINK-BELT CO., 300 W. Pershing Road, Chicago, Ill., announces that the GEORGE W. MOORE CO. of Chicago has been merged with the H. W. CALDWELL & SON CO., a subsidiary of the Link-Belt Co. The combined units are to be known as the CALDWELL-MOORE DIVISION OF THE LINK-BELT CO. Max H. Hurd, formerly president of the George W. Moore Co., becomes vice-president of the Link-Belt Co. in charge of the Caldwell-Moore operations. His headquarters will be at 2410 W. 18th St., Chicago.

R. Y. FERNER CO., 1127 Investment Bldg., Washington, D. C., has appointed the Blackman Hill Co., 1513 N. Broadway, St. Louis, Mo., exclusive representative in Missouri and southern Illinois for the sale of Swiss jig borers, precision threading lathes, and linear and circular dividing machines made by the Société Genevoise d'Instruments de Physique of Geneva, Switzerland, for which the Ferner Co. is the United States and Canadian agent. The E. A. Kinsey Co. of

Cincinnati has been appointed exclusive representative in southern Ohio and Kentucky for these machines.

HARDINGE BROS., INC., manufacturers of precision bench lathes, tool-room lathes, bench milling machines, and collets, since 1890, have transferred their general offices and factory from Chicago to a newly constructed modern plant at Elmira, N. Y. As a precision product depends on excellence of both design and workmanship, the skilled mechanics who have been with Hardinge Bros., Inc., in Chicago, were induced to move with their families to Elmira to assume their past positions in the manufacture of the Hardinge products. Complete stocks will be maintained by the Hardinge Sales Co., Inc., 277 Lafayette St., New York City; Hardinge Bros., Inc., 4553 Diversey Ave., Chicago, Ill., and Herberts Machinery Co., Ltd., Los Angeles, Calif.

WHITMAN & BARNES, INC., Detroit, Mich., announce that, in order to complete their service to users of Hercules interchangeable punches and retainers, the following die shops have been licensed to service the product and build special punch retainer plates employing the Hercules principle: Milwaukee Press & Machine Co., Milwaukee, Wis.; Quality Hardware & Machine Corporation, Chicago, Ill.; F. M. Stambaugh & Sons, Inc., St. Louis, Mo.; Buerk Tool Co., Buffalo, N. Y.; W. M. Steele Co., Worcester, Mass.; R. G. Smith Tool & Mfg. Co., Newark, N. J.; Schlosser Bros., Philadelphia, Pa.; Interstate Mechanical Laboratories, Inc., New York City; Allen Tool Corporation, Syracuse, N. Y.; Taft-Peirce Mfg. Co., Woonsocket, R. I.; and the Superior Die, Tool & Machine Co., Columbus, Ohio.

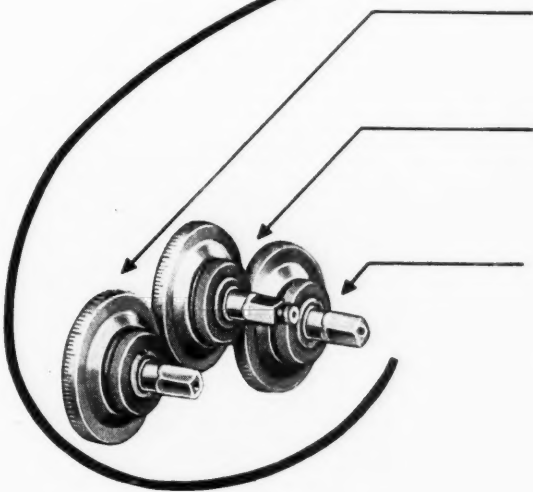
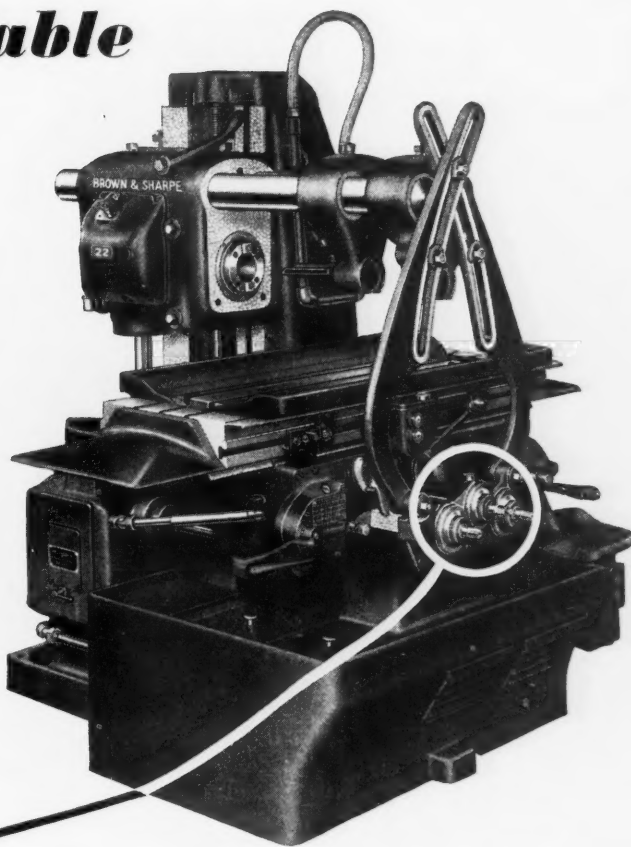
PRATT & WHITNEY CO., Hartford, Conn., announces that it has purchased the entire factory of the Keller Mechanical Engineering Corporation, 70 Washington St., Brooklyn, N. Y., manufacturer of a line of automatic die-sinking and tool-room machinery and other miscellaneous precision tools. It is intended to move the plant from Brooklyn to Hartford, including all machinery, equipment, tools, fixtures, patterns, and inventory, which will be located in some of the buildings formerly occupied by the Pratt & Whitney Aircraft Co. The Pratt & Whitney Co. assumed the management of the Keller business on October 1, and operations will be continued at the present plant in Brooklyn until some time in November, when the plant will be transferred to Hartford. It is planned to have the new plant completely installed and in operation in Hartford on or before December 1. Alexander S. Keller has been appointed manager of the Keller Division of the Pratt & Whitney Co. Joseph F. Keller, one of the original founders of the business, will also be associated with the company in an advisory capacity. Many of the executives and workmen of the Keller organization will be retained.

QUICK—ACCURATE DIALING

from **Front of Table**

on the No. 22 Plain Milling Machine

HERE is an outstanding feature of the No. 22—enabling economical handling of jobs where frequent settings of the spindle, table and saddle are necessary. Location of all controls within reach of operator *saves time*—and large, graduated dials *assure accuracy* in setting.



TRANSVERSE ADJUSTMENT OF SADDLE
—loosen saddle clamp lever (at front of machine) and rotate hand crank.

LONGITUDINAL ADJUSTMENT OF TABLE
—place directional control lever in neutral and rotate hand crank.

VERTICAL ADJUSTMENT OF SPINDLE
—loosen overarm brace bolts, unclamp spindle head (single lever) and rotate hand crank.

A sixteen-page folder giving the advantages of this machine on Short and Long Run Production Jobs will be sent on request.

BROWN & SHARPE

BROWN & SHARPE MFG. CO.



PROVIDENCE, R. I., U. S. A.

Coming Events

NOVEMBER 30-DECEMBER 4—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies' Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York.

DECEMBER 10—Meeting of the Steel Founders' Society of America at Hotel William Penn, Pittsburgh, Pa. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

DECEMBER 10-11—Seventh annual conference on welding to be held by the Engineering Extension Department of Purdue University at Lafayette, Ind.

JANUARY 21—Annual meeting of the Steel Founders' Society of America at Chicago, Ill. G. P. Rogers, managing director, 932 Graybar Bldg., New York City.

MARCH 7-12—Packaging, Packing, and Shipping Exposition to be held at the Palmer House, Chicago, Ill., under the auspices of the American Management Association. Exposition headquarters, Room 602, 225 W. 34th St., New York.

New Books and Publications

REPORT OF STRUCTURAL STEEL WELDING COMMITTEE OF THE AMERICAN BUREAU OF WELDING. 208 pages, 6 by 9 inches. Published by the American Welding Society, 33 W. 39th St., New York City. Price, \$1.

KINEMATICS OF MACHINERY. By C. D. Albert and F. S. Rogers. 527 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York City. Price, \$4.50.

This book is the outgrowth of the experience of the authors in teaching kinematics to engineering students in the College of Engineering at Cornell University. The book presupposes a course in engineering mechanics. A number of questions and problems that completely cover the subject matter of the text are given at the end. The material is divided into thirteen chapters headed as follows: Fundamental Conceptions; Transmission of Motion; Analysis of Plane Motion; Velocity and Acceleration Vector Diagrams; Cams; Rolling Curves and Friction Gearing; Straight and Helical Spur Gears; Cutting of Straight and Helical Spur Gears; Straight and Spiral Bevel Gears—Cutting of Bevel Gears; Helical and Hyperboloidal Gears—Cutting of Helical Gears; Linkwork and Miscellaneous Mechanisms; Belt, Rope, and Chain Transmission; and Trains of Mechanism.

SECONDARY ALUMINUM. By Robert J. Anderson. 563 pages, 6 by 9 inches. Published by the Sherwood Press, Inc., Box 2617, Lakewood Branch, Cleveland, Ohio. Price, \$10.

In the early days of the secondary aluminum industry, secondary metal was looked upon with suspicion. However, the shortage of aluminum during the war years proved that secondary and scrap metal could be used to advantage. Comparatively little has been published up to the present time on the production and utilization of secondary aluminum. On this account, the present work, written by a man having many years of experience and study in the aluminum field, should be of considerable interest. The author has endeavored to bring, within a reasonable number of pages, a sufficiently balanced blending of theory, plant operation, and commercial practice to make the book of value not only to aluminum metallurgists, secondary remelters, scrap dealers, and manufacturers of reduced scrap, but also to consumers of aluminum

and its alloys, especially foundrymen. Some of the important subjects dealt with are aluminum scrap, marketing, sampling, alloys, fluxes, furnaces, blending, technical control, by-products, equipment, costs, and economics.

MECHANICAL CATALOGUE (1931-1932). 990 pages, 8½ by 11¼ inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City.

This is the twenty-first annual edition of a work containing illustrated catalogue information, conveniently classified, describing the products of manufacturers of mechanical equipment, together with a directory of manufacturers of industrial equipment, materials, and supplies. The present edition contains 647 pages of products data, made by 488 manufacturers. There are 6500 classifications of equipment in the directory, and 4600 firms are listed. The volume has eleven sections devoted to apparatus with which the mechanical engineer is concerned. The sections are as follows: Power plant equipment; measuring and testing apparatus; power transmission machinery; materials handling equipment; metals, alloys, and other materials; foundry, rolling mill, and forge equipment; metal-working machinery, machine tools, and shop equipment; compressors, blowers, and pumps; heating and ventilating equipment and refrigerating machinery; specific industry machinery and general industrial equipment; electric motors and control. The twenty years during which the Mechanical Catalogue has been published have amply proved its usefulness as a reference publication.

AMERICAN BUSINESS PRACTICE. Editors-in-Chief: James C. Egbert, Elmer A. Holbrook, Morton A. Aldrich. 4 volumes, 3068 pages, 5 by 8 inches. Published by the Ronald Press Co., 15 E. 26th St., New York City. Price, \$14.75.

These four volumes cover comprehensively the entire field of business practice as applied to industrial enterprises. Different sections deal with organization, capital, marketing, selling, advertising, office systems, traffic management, correspondence, foreign trade, accounting, finances, credits, budgets, investments, manufacturing procedure, purchasing, factory costs, real estate, and business law. Under each of these headings, the essential branches of business procedure are dealt with. The manufacturing side alone, for example, covers comprehensively the subjects of manufacturing organization, the factory working forces, factory buildings and equipment, purchasing of manufacturing materials, control of materials of manufacture, factory production, standardization of factory work, factory wage plans, and factory cost accounting.

It is not possible, in a brief review, to deal in detail with any one of these sections of the work. An outline of the general contents, as presented, gives a better idea of the broad scope of these volumes than general references to specific items could. In all, the work contains 213 chapters, each concisely dealing with one specific subject. To the best of our knowledge, this is the first time that a work has been offered on business practice and factory systems dealing with the subject in so complete a manner in a limited number of volumes. The work should be of particular value to young men who wish to obtain a comprehensive foundation on which to build success in the business or manufacturing field.

Societies, Schools and Colleges

OHIO MECHANICS INSTITUTE, Central Parkway and Walnut St., Cincinnati, Ohio. Announcement of the evening classes for 1931-1932.

New Catalogues and Circulars

ELECTRIC FIXTURES. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2235, containing data on various types of vaporproof industrial lighting fixtures.

WELDING MACHINES. General Electric Co., Schenectady, N. Y. Loose-leaf bulletin, describing the characteristics of the new G-E arc welders.

X-RAY APPARATUS. Kelley-Koett Mfg. Co., Inc., Covington, Ky. Series of bulletins descriptive of the various types of X-ray apparatus made by this concern.

CHAMFERING MACHINES. City Machine & Tool Works, E. 3rd and June Sts., Dayton, Ohio. Circular outlining the main features of the new No. 3 Peerless chamfering machine.

HOLLOW-MILLS. Gairing Tool Co., 1620 W. Lafayette Blvd., Detroit, Mich. Bulletin illustrating the outstanding features of the Gairing adjustable-plate heavy-duty hollow-mill.

MATERIAL - HANDLING EQUIPMENT. American Car & Foundry Co., 30 Church St., New York City. Bulletin containing a pictorial summary of the A.C.F. line of industrial railway equipment.

NON-SKID FLOOR PLATES. Inland Steel Co., First National Bank Bldg., Chicago, Ill. Folder descriptive of the new Inland four-way floor plate, so designed as to be "non-skid" in all four directions.

HEAT-TREATING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Leaflet in the Hump & Homo Series, describing Homo tempering equipment and its use in the automotive industry.

WELDED MACHINERY BASES. Lincoln Electric Co., Cleveland, Ohio. Application Sheet No. 23, Series 2, continuing the discussion of the design of welded machine bases that was started in a previous sheet.

PRECISION GRINDING MACHINES. Churchill Machine Tool Co., Ltd., Broadheath, Manchester, England. Leaflet DBJ-2, illustrating and describing the Churchill double-ended axle journal regrinding machine.

ELECTRIC FURNACES. W. S. Rockwell Co., 50 Church St., New York City. Bulletin 320, illustrating various types of electric and fuel furnaces for ferrous and non-ferrous metals, and ceramic and chemical products.

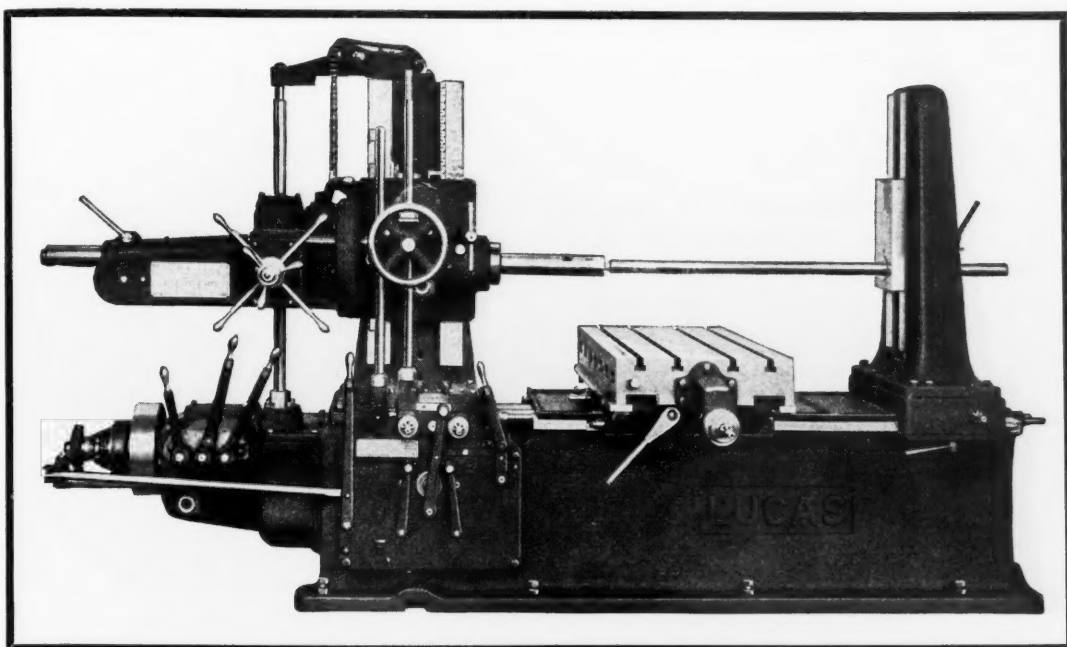
RAMET. Ramet Corporation of America, North Chicago, Ill. Pamphlet outlining the advantages and economies to be obtained through the use of the tantalum-carbide alloy Ramet as a cutting metal for machine tools.

INDICATING AND CONTROLLING INSTRUMENTS. Brown Instrument Co., 4485 Wayne Ave., Philadelphia, Pa. Circular announcing the Brown potentiometer pyrometer for applications requiring maximum accuracy.

FLEXIBLE COUPLINGS. Clark Coupling Co., 149 Church St., New York City. Bulletin descriptive of the construction of Clark triplex, simplex, and marine couplings. Dimensions, capacity, and prices are given for the various sizes.

PIPE TOOLS. Borden Co., Warren, Ohio. Condensed catalogue 32, giving concise information on the Beaver line of pipe machines. Nine new tools are shown in this catalogue, as well as outstanding improvements in early models.

FORMICA GEARS. Earle Gear & Machine Co., 4709 Stenton Ave., Philadelphia, Pa. Leaflet outlining the characteristics of Formica



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FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. Andrews & George Co., Tokyo. Catmur Machine Tool Corp., Ltd., London, Eng. M. Kocian & G. Nedela, Prague. V. Lowener, Copenhagen, Oslo, Stockholm. Emanuele Mascherpa, Milan, Italy. R. S. Stokvis & Zonen, Rotterdam, Paris.

gears, which are especially adapted for locations where gears are subjected to moisture and chemicals.

METAL HOSE. Seamlex Corporation, 1028 Forty-seventh Ave., Long Island City, N. Y. Bulletin 311, showing typical examples of Seamlex flexible seamless metal hose, and describing the particular use for which each style is adapted.

ELECTRICAL MEASURING INSTRUMENTS. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Catalogue 87, outlining the features of construction, advantages, and applications of Micromax potentiometer pyrometers.

TUNGSTEN-CARBIDE TOOLS. Metal Carbides Co., 361 Jelliff Ave., Newark, N. J. Catalogue 31-7, listing various styles and sizes of tools made from Talide, a tungsten-carbide alloy. Price lists for these tools have also been issued.

ELECTRIC EQUIPMENT. Allen-Bradley Co., 1331 S. First St., Milwaukee, Wis. Bulletins 715 and 742, illustrating and describing, respectively, automatic multi-speed, across-the-line switches, and automatic increment starters for network systems.

WELDED GEARS. Lukenweld, Inc. (Division of Lukens Steel Co.), Coatesville, Pa. Circular descriptive of the production of welded steel gears from blanks of Lukenweld construction. The advantages of this form of construction are pointed out.

LUBRICATED VALVES. Merco Nordstrom Valve Co., 343 Sansome St., San Francisco, Calif. Catalogue containing 172 pages illustrating approximately thirty types of Nordstrom lubricated plug cock valves for handling liquids, semi-liquids, and gases.

RAMET-TIPPED TOOLS. Illinois Tool Works, 2501 N. Keeler Ave., Chicago, Ill. Catalogue listing the standard sizes of Ramet-tipped tools. Each design is designated by letter symbols that indicate special dimensions, for convenience in ordering.

WOODWORKING MACHINERY. Oliver Machinery Co., Grand Rapids, Mich. Circular illustrating and describing the Oliver No. 272 single-spindle borer, with combination power or foot feed, stationary head, reciprocating spindle, and universal adjustments.

FLEXIBLE-SHAFT EQUIPMENT. N. A. Strand & Co., 5001-5009 N. Lincoln St., Chicago, Ill. Bulletin illustrating the standard line of Strand motor-driven flexible-shaft equipment, including tool- and die-makers' and metal patternmakers' equipment.

ELECTRIC FURNACES. Hevi Duty Electric Co., Milwaukee, Wis. Bulletin 931, describing the advantages of the Carbonal process of carburizing steels and the results obtained in carburizing steels in the electric vertical carburizing furnaces made by this concern.

MATERIAL-HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the use of the Cleveland overhead tramrail system for handling loads ranging from 2 pounds to 10 tons.

FLEXIBLE-SHAFT MACHINES. McNeil Bros. Co., Cincinnati, Ohio. Circular giving specifications for the Model M series of flexible-shaft machines, hand pieces, form filing tools, and tool-box. Circular illustrating McNeil attachments and accessories for flexible-shaft machines.

THRUST BEARINGS. Kingsbury Machine Works, Inc., Frankford, Philadelphia, Pa. Bulletin HV, listing dimensions, capacities, and weights of self-aligning equalizing types of

Kingsbury vertical and horizontal thrust bearings. Typical mountings of these bearings are illustrated.

WROUGHT-STEEL WHEELS. Carnegie Steel Co., Pittsburgh, Pa. Catalogue describing in detail Carnegie rim-toughened wrought-steel wheels, which are especially applicable for railway service, crane installations, and other applications where severe conditions of service are encountered.

SMALL TOOLS. Brown & Sharpe Mfg. Co., Providence, R. I. Circular entitled "Good Products Depend Upon Accuracy," showing typical examples of Brown & Sharpe precision tools, including micrometers, rules, straightedges, squares, gages, calipers and dividers, and toolmakers' tools.

AIR-FINISHING EQUIPMENT. Paasche Airbrush Co., 1909 Diversey Parkway, Chicago, Ill. Bulletin E9-31, entitled "Air in the Automotive Industry," illustrating various types of air-finishing, air-painting, air-oiling, and air-conditioning units especially applicable to the automotive industry.

PRESSES. Oilgear Co., 647 Park St., Milwaukee, Wis. Bulletin 30,000, illustrating and describing the Oilgear line of presses for broaching, assembling, straightening, and general manufacturing. Descriptions of the new streamline presses, as well as special presses that have not previously been shown, are included.

SHAKEPROOF WASHERS. Shakeproof Lock Washer Co. (Division of Illinois Tool Works), 2553 N. Keeler Ave., Chicago, Ill. Pamphlet entitled "The Secret of Shakeproof's Great Locking Power," explaining the principle of design of Shakeproof lock washers and their application in a wide variety of industries.

HEAT-TREATING EQUIPMENT. General Electric Co., Schenectady, N. Y. Circulars GEA-1324A and 1495, illustrating and describing, respectively, G-E air-drawn furnaces for the quantity drawing of steel parts at temperatures up to 1200 degrees F., and G-E bell-type furnaces for the bright annealing of coiled steel strip.

PORTABLE ELECTRIC TOOLS. United States Electrical Tool Co., 2477 W. 6th St., Cincinnati, Ohio. Catalogue covering the U. S. line of portable electric tools, including drills, buffers, grinders, and flexible-shaft machines, tools, and attachments. A full line of portable electric saws is shown in this publication for the first time.

ZINC PRODUCTS. New Jersey Zinc Co., 160 Front St., New York City. Research bulletin giving information on the plating of rolled zinc and zinc die-castings. Condensed information on this subject is also issued in the form of a wall chart for ready reference. Catalogue illustrating numerous examples of zinc die-castings in a wide variety of industries.

DIAMOND BORING MACHINES. Ex-Cell-O Aircraft & Tool Corporation, 1200 Oakman Blvd., Detroit, Mich. Bulletin illustrating and describing in detail the construction of the Ex-Cell-O Model No. 112 precision boring machine which is adapted for average production of pistons, connecting-rods, transmission gears, motor end frames, air valves, and similar parts.

ELECTRIC TRUCKS. Elwell-Parker Electric Co., Cleveland, Ohio. Bulletin entitled "Engineering Electric Trucks to Fit Your Job," showing examples of special truck and tractor models built for unusual jobs, as well as modifications of standard designs for a wide variety of applications. Special attachments that adapt the trucks for different classes of work are also shown.

CARBON TOOL STEEL. Carpenter Steel Co., Reading, Pa. Catalogue containing data on tough carbon tool steel. The catalogue de-

scribes the acid test and the timbre test for inspecting tool steel, and gives the constituents of special tool steels, as well as the application for which each grade is most suitable. Heat-treating instructions for these tool steels are also included.

PRECISION BORING MACHINE. R. Y. Ferner Co., 1127 Investment Bldg., Washington, D. C. Catalogue entitled "World's Standard of Speed and Precision," containing reproductions of advertisements showing the application of Swiss high-speed precision jig borers on a wide variety of work, and the savings effected through their use. Complete performance data are given in each case.

WELDING AND CUTTING EQUIPMENT. Torchweld Equipment Co., 224 N. Carpenter St., Chicago, Ill. Pocket-size catalogue No. 31, containing detailed information regarding the Torchweld line of gas welding and cutting equipment. Various styles of welding or cutting torches, units, and gas pressure regulators, suitable for different manufacturing requirements, are described and illustrated.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins GEA-246C, 318D, 560B, 720B, 1464, 1475, and 1483, illustrating and describing, respectively, general-purpose synchronous motors; insulator units for outdoor devices; constant-speed, single-phase motors; direct-current, high-speed circuit-breakers; automatic switchgear for industrial service; single-phase vertical motors; and medium-speed, alternating-current generators for belt drive or direct connection.

LABORATORY APPARATUS. American Instrument Co., Inc., 774 Girard St., N.W., Washington, D. C. Bulletin illustrating and describing the Tuckerman optical strain gage for the precise measurement of tension and compression strains in hot and cold metal specimens, and for the testing of riveted joints. Circular descriptive of the automatic metallographic polishing machine for polishing metals for microscopic examination. Leaflet describing a method for studying the casting qualities of metals.

LEATHER BELTING. J. E. Rhoads & Sons, 35 N. 6th St., Philadelphia, Pa., are distributing an attractive booklet, of vest-pocket size, known as the "Belt User's Book." This is the ninth edition of this publication, which contains rules, tables, and charts of use to the designer and user of belt drives. Brief information on short-center drives and group and individual drives has been added in the new edition. The material in the previous edition has been carefully revised and brought up to date.

FLEXIBLE COUPLINGS. Morse Chain Co. (Division of Borg-Warner Corporation), Ithaca, N. Y. Bulletin 47, descriptive of Morse flexible couplings. The booklet outlines the advantages of the design of these couplings and gives information on how to select the proper coupling for various drives. Several pages of rating curves are given, showing the size of coupling required for any given horsepower and speed. Prices and dimensions of standard couplings are also included. The book is handsomely made up, and is an unusually attractive example of typography.

ROLL GRINDING MACHINES. Cincinnati Grinders, Inc., Cincinnati, Ohio. Catalogue illustrating and describing the new Cincinnati 20-, 24-, 28-, 32-, and 36-inch roll grinding machines. Specifications are listed for forty-nine sizes of these machines. Particular attention is called to the arrangement for producing convex and concave surfaces on the roll faces. Among the advantages pointed out for finishing and reconditioning rolls by grinding are increased accuracy of journals and roll bodies, parallelism, improved finish, reduction in machining time, and longer roll life.